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The Mining Journal

LONDON, APRIL 22, 1960

Vol. 254. No. 6505.

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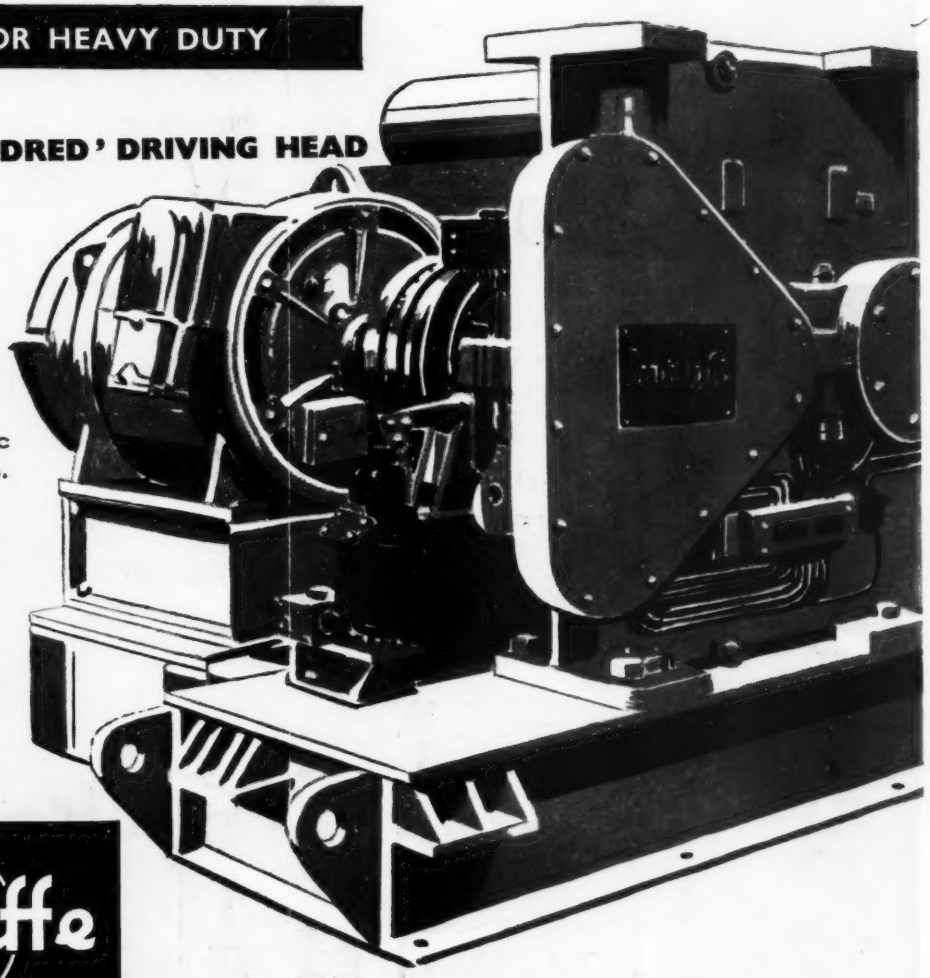

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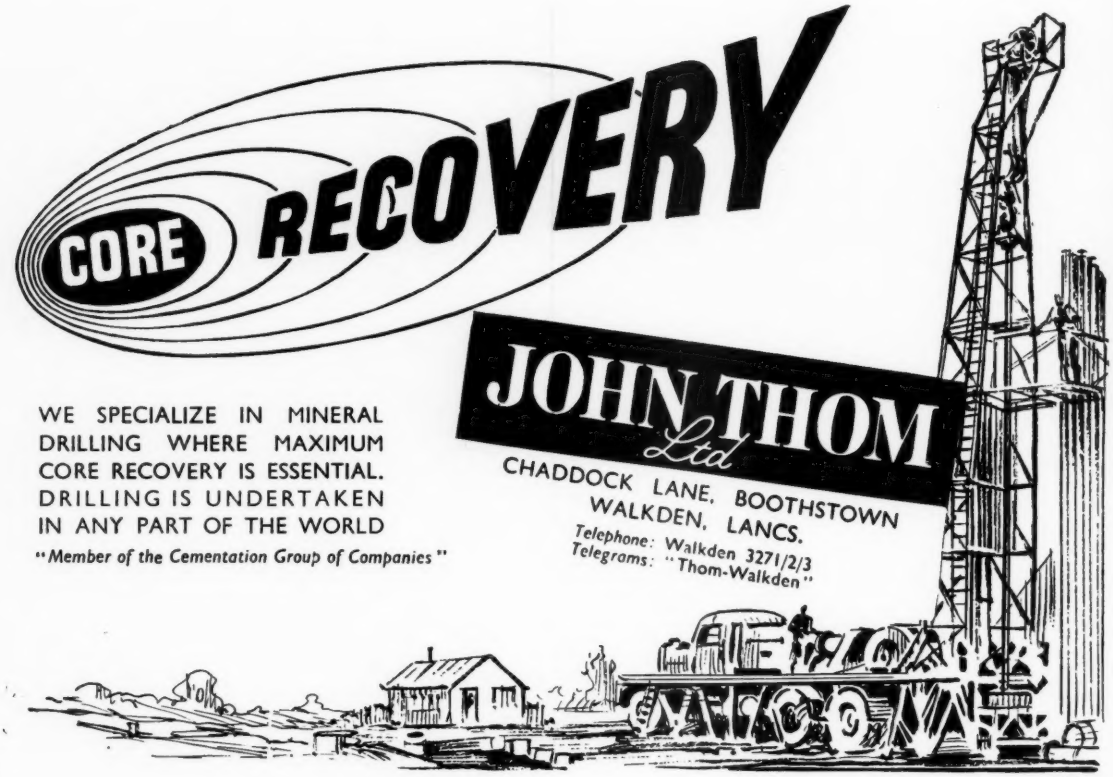

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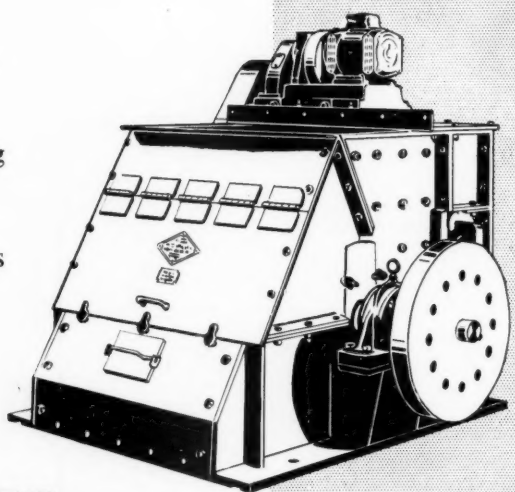

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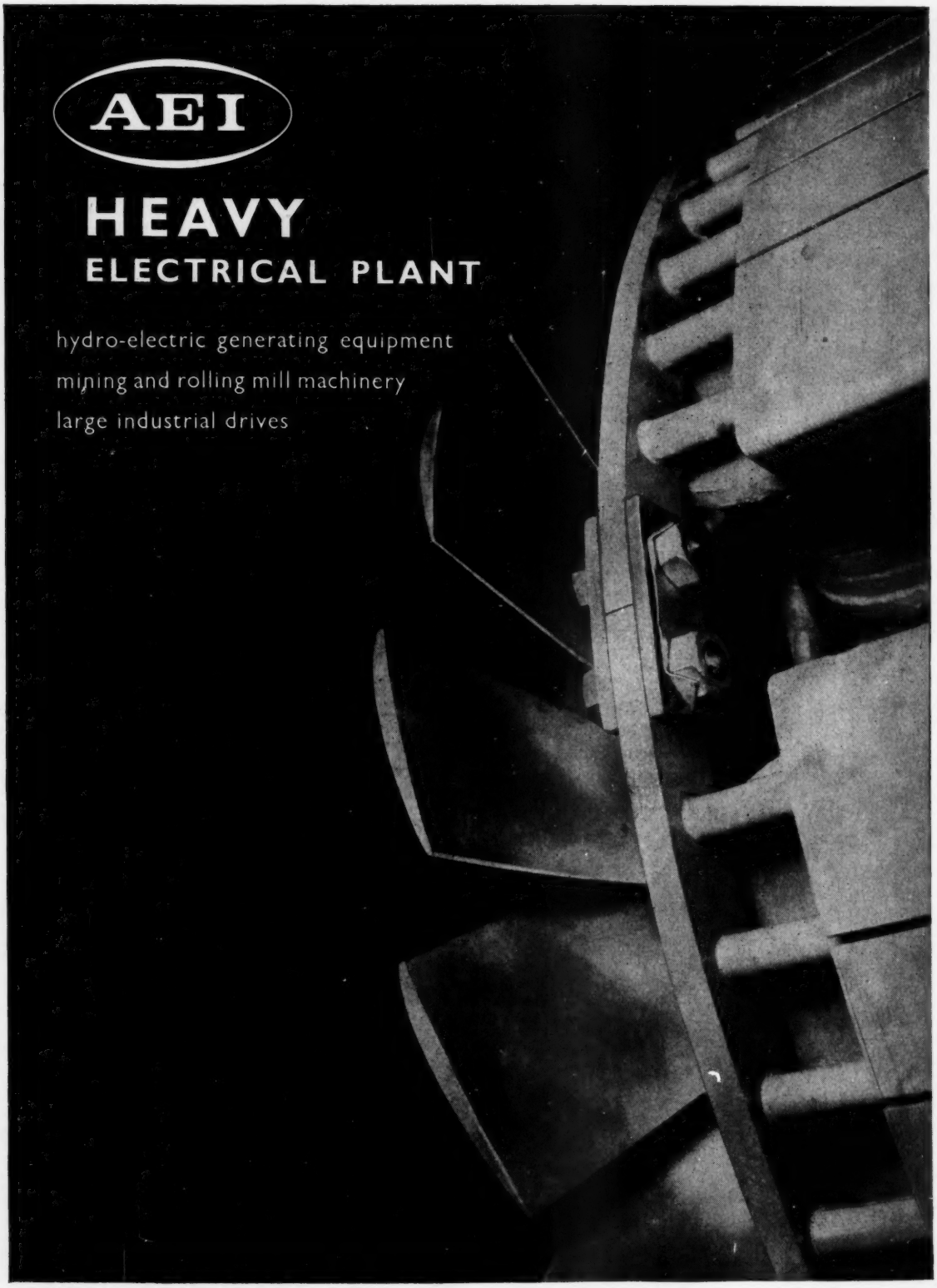

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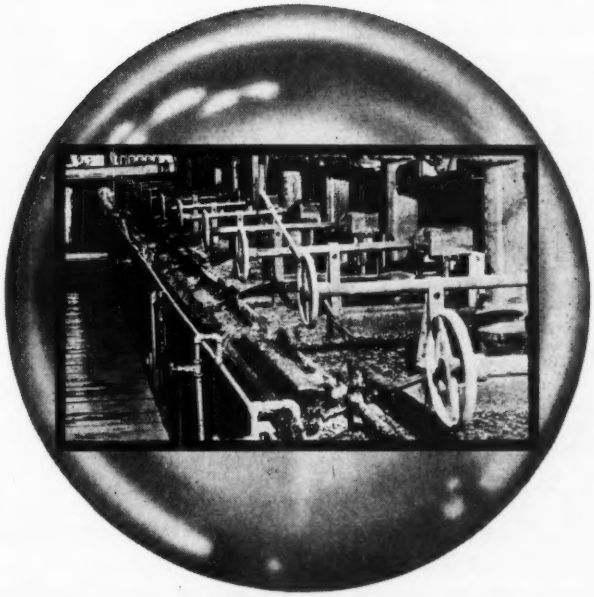

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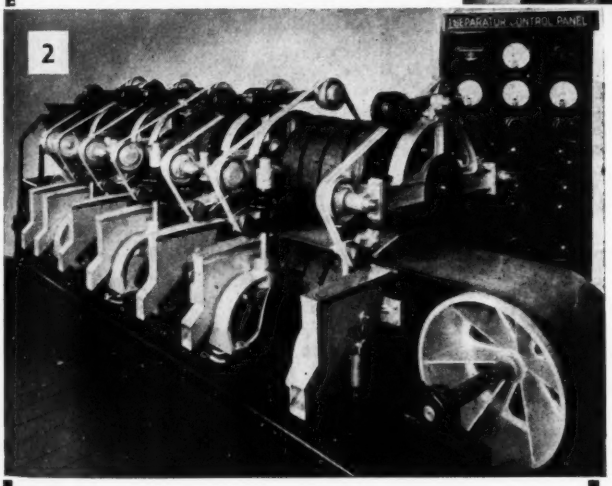

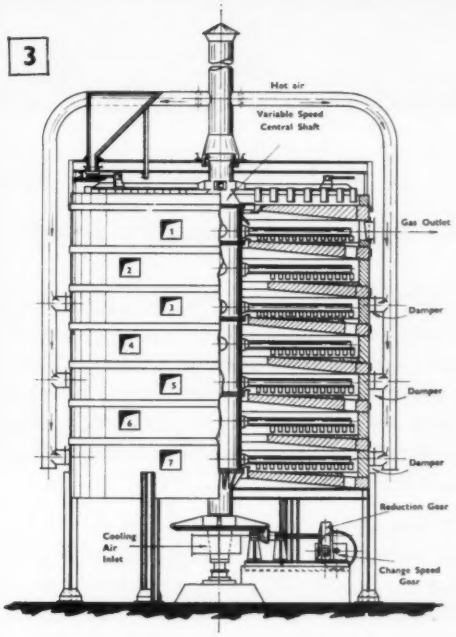

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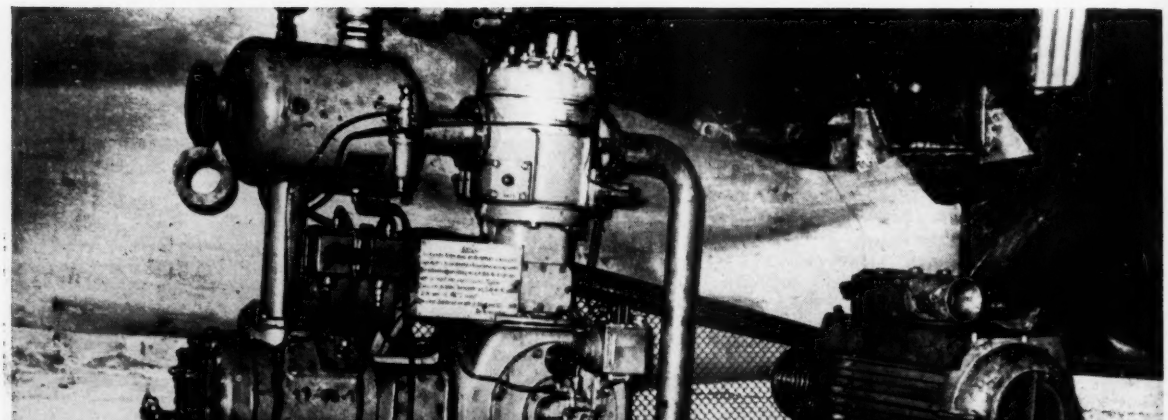

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Picture shows an AG1-2 installed in a Sarre coal mine in Belgium which has resulted in the advance rate being increased by 30%. With an output of 45 m³/min (1600 c.f.m.) at 7 kg/cm² (100 p.s.i.) when drawing air of 4.5 kg/cm² (65 p.s.i.) from the main system, the booster has enabled the penetration speed of the rock drills to be increased by 40% and the mucking time to be reduced by 30%. Similar figures have been obtained in collieries in Northern and Eastern France.

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The Mining Journal

London, April 22, 1960

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Vol. 254 **No. 6505**

Established 1835

Editor
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Circulation
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Published each Friday by
THE MINING JOURNAL LTD.

Directors
E. Baliol Scott (*Chairman*)
U. Baliol Scott (*Managing*)
G. A. Baliol Scott
R. A. Ellefsen

15 WILSON STREET, LONDON, E.C.2

Telegraphic Tutwork London
Telephone MONarch 2567 (3 lines)

Annual Subscription £3 10s. Single copy ninepence

Australia's Nuclear Energy Programme

THE lull in demand for uranium anticipated during the present decade presents problems for Australia's uranium industry, which is now in steady production and has sufficient proved ore reserves to fulfil current contracts, and to meet Australia's foreseeable domestic requirements until about 1980.

The following enterprises are now producing uranium oxide for export : Rum Jungle (a Commonwealth Government undertaking) and Radium Hill (a South Australian Government undertaking) are both under contract to supply the Combined Development Agency. Mary Kathleen Uranium Ltd., United Uranium N.L. and South Alligator Uranium N.L. are all public companies selling oxide under contract to the U.K. Atomic Energy Authorities. Exploration and development have brought about a continuing rise in ore reserves and production, and today the aggregate output of the five Australian producers is in the region of 1,000 tons of uranium oxide a year.

Mining operations at Rum Jungle were completed in November, 1958, all the ore having been extracted from White's deposit, Dyson's deposit and Mt. Burton. However, treatment operations are continuing on the same scale as formerly with ore from the stockpiles, which are more than sufficient to complete the contract with the Combined Development Agency. The Rum Jungle area is being systematically explored with a view to establishing further reserves of ore.

The last of the Australian contracts will be completed by 1966 or perhaps a little sooner but others, including that of Rum Jungle, expire by about the end of 1962. In common with Canadian and South African producers, the Australian producers are therefore interested in the possibility of securing overseas markets when the contracts are finished. In view of the fact that other producing countries will also be seeking outlets, it is evident that until demand has caught up with supply, competition for available markets must obviously be intense.

Having fostered a successful uranium mining industry, the Australian Government is anxious to keep it alive and active. In its report for 1958/59, the Australian Atomic Energy Commission emphasizes the desirability of maintaining an active mining industry in order that new reserves may be developed, and to ensure that Australia's long-range needs will be provided for. The Commission's policy is therefore to give what help it can to mining companies seeking export markets if their output is not immediately required in Australia. Emphasis is laid in the report, however, on the cardinal principle of the Commonwealth Government that any exports made in this way shall be strictly for peaceful purposes. The Commonwealth Government has made it clear that although it believes mining companies should be encouraged to produce and deal in uranium as a commercial commodity, the special nature of the material makes it essential that commercial transactions should be appropriately safeguarded.

This, of course, is the purpose of the controversial system of bilateral agreements providing that material shall not be used for military purposes, which, in view of the present glut of uranium, are regarded in some quarters as merely hampering producers in their efforts to develop export markets without any longer serving their prime purpose of debarring potential aggressor nations from access to nuclear fuels.

Australia's own nuclear research programme continues to make steady progress. In the words of the Minister of State for National Development, Senator the Hon. W. H. Spooner, the question is not whether nuclear power will be needed on a substantial scale in Australia, but *when* it will be needed. On present indications, nuclear stations will be under construction by the end of this decade. This does not mean that atomic power will then be competitive in all circumstances with other forms of power. There are areas in Australia, however, where the coal and water resources needed for coal-fired or hydro-electric stations are either not economical or else non-existent. It is hoped that suitable reactors will be evolved which will provide power at economic rates for these areas.

A thermal reactor system likely to compete with costs of the majority of new coal-burning stations in Australia must meet the following specifications: An electric output of the order of half a megawatt per lb. of fissile material; long-lived, high integrity fuel elements designed to give a burn-up of about unity (i.e., before it becomes necessary to replace the fuel, an amount of fissile material equal to the whole of its original fissile content will have been consumed); a reactor system with a conversion factor of about unity (i.e., one where new fuel is bred from thorium at about the same rate as the original fuel is consumed); an outlet coolant gas temperature of over 500 deg. C. to provide an efficient turbine cycle; and, finally, a low capital cost for the reactor core. The Commission reports that a useful start has been made in the programme of research into the various possible ways of meeting these requirements.

GREECE LOOKS TO HER MINERALS

The Greek Government is making efforts to step up the country's industrialization drive. The aims are to step up the execution of major development projects under construction or included in the government's 5-year development programme, whose revision on a 10-year basis is making headway; to create new industries for the manufacture of materials which are not at present produced in Greece—such as calcium carbide and zinc oxide, in the minerals field ; to accelerate the prospecting and tapping of Greece's underground resources (liquid fuels and natural gases as well as various ores) and to create new industries for their exploitation, such as aluminium production plants, and iron and steel foundries. A programme has been approved for the carrying out of large-scale research and prospecting by the Greek Institute for Geology and Subsurface Research—which now comes under the Mining Department of the Ministry of Industry—and by foreign experts.

Within the pattern of this industrialization drive, the signing has now taken place of the assignment to various German firms of consultant engineers of all 13 technical surveys to be paid from German technical aid to Greece. Already experts have come to Greece on behalf of these firms to collect data useful in drawing up their surveys for eight out of thirteen of these projects. Amongst them are Dr. Lueth, who is responsible for the surveys regarding a ferro-manganese industry and also concerning an iron and steel industry, the surveys for the extension of the Ptolemais lignite mines are under the control of Dr. Ehlers and for the creation of Megalopolis lignite mines, the latter work being undertaken by Dr. Gold. Tin is also under examination.

As regards the 300,000 ton per annum iron and steel industry, all possible solutions, based either on the utilization of electric power for the reduction of iron ores in electric furnaces (300,000 tons per annum is estimated to require some 750 million kilowatt-hours yearly) or on the import of coke from abroad will be considered. The Larymna nickel works run by M. Bodossakis Athanassiades in collaboration with Krupps, proposes to produce 90,000-100,000 tons of steel annually concurrently with its nickel output.

GABOON GETS GEARED FOR MINING

In forming the basis of the growing mineral exploitation industry in the French Community state of Gaboon, three companies between them will set schemes into motion within the next two years which will become the backbone of that African country's economy.

In July of next year exploitation will be commenced by the Compagnie des Mines d'Uranium de Franceville of the uranium ore deposits in the Maunana region. With the Compagnie de Mokta-el-Hadid and the Commissariat à l'Energie Atomique (French Atomic Energy Commission) as main shareholders, the Franceville concern will work to an initial capacity of some 2,500 tonnes of concentrate with 10 to 20 per cent uranium content over the first few years of operation. The deposit is reckoned to be of some 20,000,000 tonnes, with uranium content of 4,000 to 5,000 tonnes.

The year 196' is expected to see commercial exploitation of the Mouanda manganese deposits near Franceville by the Compagnie Minière de l'Ogooué (COMILOG), which started preliminary work on the site last September. The reserves are estimated at 100,000,000 tonnes of 50 per cent manganese content ore, and initial annual production is put at 500,000 tonnes. The concern is owned by a Franco-American consortium, and 49 per cent of its shares belong to the United States Steel Company.

Exploration in the iron ore deposit area in eastern Gaboon is at present being continued by the Société des Mines de Fer de Mékambo, owned by an international consortium, and exploitation is thought to become possible after another two years of study work. In the case of exploration, a rail line would have to be laid over the 470 miles between Mékambo and the Gaboon delta. The company is owned 50 per cent by Bethlehem Steel, of the United States, 34 per cent by a French group consisting of Bureau de Recherches Géologiques et Minières (12%), Sidérurgie Francaise (9%), Banque de Paris (5%), the Suez Company (5%) and COFIMER (3%) and the remaining 16 per cent by a third group consisting of an Essen ferrous consortium (10%), Fiat of Italy (3½%), the Belgian concerns L'Esperance and La Providence (together 2%) and the Dutch Hoogovens concern (½%).

PROBLEMS OF BOLIVIA'S MINING INDUSTRY

Economically, 1959 ended on a fairly optimistic note for Bolivia, reports the Board of Trade, Export Services Branch, in *Export Service Bulletin Weekly Supplement* (C.R.E. 11840/58), with the rate of exchange continuing steady, foreign reserves on December 31 at their highest for many months, and a relatively quiet labour situation. Bank credit was freed on November 1 and here were one or two other signs of incipient economic expansion. The railways, however, continue to suffer heavy financial losses.

The year's most encouraging development was the successful inauguration of a new well in the Madrejones concession of the Bolivian Oil Co. on November 26, which, it is hoped, will produce 2,500 - 3,000 barrels a day during 1960. Another notable event was the start of production by the U.S. Co., South American Placers, which has invested $U.S.3,000,000 in its operations in Bolivia. This company began exploiting its concession in Teoponte, in the Upper Beni, on October 3.

It is hoped to dredge some 200,000 cu. yds. of auriferous sand daily and to produce about 100 kilos of gold a month.

On the other hand, the operations of the State Mining Corporation (Comibol) gave little cause for satisfaction. Still burdened with excessive and poorly disciplined labour forces, the State mines continue to make heavy losses. The question of subsidized food prices in Comibol's commissaries has continued to present a serious problem, and in December instructions were issued for the rationing of issues of bread, rice, meat and sugar. It was explained to the workers that the corporation had lost $U.S.7,000,000 in its operations in the first six months of the year alone and could not continue sustaining heavy losses on its food sales.

There was further talk during the period of the need to reorganize Comibol on a more efficient basis and some attempts were made by the President, Dr. Guillermo Bedregal, to convince union leaders and members of the necessity for tolerance and reform, but without apparent result. A document explaining in detail the reasons for the management's decision in October to close the uneconomic mine at Pulacayo was also presented to the Mineworkers' Union.

The long-standing problem of compensation payments in respect of the mines now operated by Comibol and formerly the property of Patino, Hochschild and Aramayo, has still not been resolved. Antenor Patino and Mauricio Hochschild were reported in October and November to have submitted further requests to the Bolivian Government for an early settlement. More recent reports have, however, suggested that settlement in respect of the Patino properties may be nearer.

Shortly after the signature of the loan agreement concluded last year between representatives of the British tin smelters and Comibol, reports began circulating that a part of the £2,000,000 loan, instead of being spent in purchasing machinery and equipment to boost production, had been used to meet other commitments of the corporation. Announcements in December made it clear that about 20 per cent of the loan had, in fact, been applied to payment of " aguinaldos " (Christmas bonuses) to the mine workers and that another large portion had gone towards remedying a part of Comibol's current deficit with other State entities.

It was announced, following the International Tin Council's meeting in London on December 1, that tin quotas for the first quarter of 1960 would be 20 per cent above those for the last quarter of 1959, Bolivia's new quota being fixed at 7,096.1 fine tonnes. Although internal restrictions on exports by the private mines have been lifted, it is doubtful whether production will reach this level. Comibol's output of tin in the period Jan.- Nov., 1959, amounted to approximately 14,470 l. tons. Shipments under the Barter arrangement with Philipp Brothers and the Commodity Credit Corporation were reported to have been completed in December.

Heavily in debt, like Comibol, and having refused an offer of a loan of £200,000 from the British tin smelters in return for an extension of their ore-buying contracts, the Banco Minero began negotiations in October for a loan of approximately $U.S. 850,000 from the Union Bank of Switzerland, against a deposit of approximately 830 kilos of gold. In November, the Banco Minero's President, Sr. Jorge Salazar Mostajo, visited Switzerland to complete the loan arrangements and discuss prospects for a further loan of about the same amount.

It was reported in October that a Peruvian company—Compania Metalurgica Sociedad Anonima (CIMETAL) of Lima—was considering investing an amount of $U.S.500,000 in the (high-grade) tin smelter, Fundicion de Estano Oruro (Bolivia) S.A., with the object of modernizing and extending the plant and increasing its output of tin to 3,500 tons per annum, all purchased by the Peruvian concern.

According to unconfirmed Press reports a Japanese concern, the Compania Metalera Minera " Nitto ", has signed a contract with the owner of the " Chacarilla " group of mines, under which the " Nitto " company will develop and exploit the mines' extensive copper deposits. The group's present output was said to be 120 tonnes per month of 20 per cent pure copper. Other unsubstantiated reports suggested that plans were being considered by Comibol for the transfer of the " Matilde " zinc mine near Lake Titicaca to a European and Japanese consortium prepared to invest up to $U.S.10,000,000 in its rehabilitation.

The United Nations Technical Adviser to the Bolivian Government on Minerals and Petroleum has made a further plea for the early introduction of an equitable and realistic Mining Code to encourage foreign investment in Bolivia. He has estimated that there is room for an investment of more than $U.S.300,000,000 in Bolivian mining.

NORTHERN RHODESIA'S KANDABWE COAL SEAM " NATIONAL ASSET "

A seam of coal discovered at Kandabwe, in the Gwembe area of the Zambezi valley, Northern Rhodesia, is described as " a national asset which could prove of value in the future . . . although it is unlikely to be of immediate economic importance ", in a report from the Ministry of Labour and Mines.

The report, prepared by Mr. R. Tavener-Smith, a geologist formerly with the Ministry's Geological Survey Department, gives the results of a detailed investigation of coal resources of the Gwembe area. Six of the seven deposits in the area are dismissed as of no economic importance. The seventh is the Kandabwe seam, discovered in 1952 when local Africans drew attention to a thick bed of coal exposed on the banks of the Kandabwe River.

Development work by shaft sinking along the strike began in the middle of 1953. Drilling operations proved that the length of the main seam was about four miles, and that the variation in thickness was between 22 and 7 feet. Total proved and possible reserves of the deposit amount to about 17,000,000 long tons, after making a 20 per cent allowance for irrecoverable coal. The report states that the quality of the coal in the seam might fairly be described as low grade. Analyses of more than 300 samples showed that the average ash content was of the order of 24 per cent and that the calorific value was 10,200 B.Th.U./lb. Rather better values were produced by analyses of the lowest six feet of coal in the area of proved reserves.

Because of the high angle of dip in the seam and the nature of the overburden, open-cast mining would not be practicable, Mr. Tavener-Smith continues. The steepness of the dip would probably make mining methods more expensive than at the Wankie field in Southern Rhodesia, with which, geologically, the Kandabwe deposit has an overall similarity. " It appears that the immediate prospects for development of the Kandabwe area are not good, though much would depend upon the price at which the coal could be marketed and the demand that could be created for it in the face of competition from Wankie and the coal fields of the Union of South Africa. Nevertheless, the existence of a small potential coal field has been proved where none was suspected, and there could be no doubt that in more favourable circumstances the coal would certainly be worked ."

Mr. Tavener-Smith concludes: " The whole of the Karroo rocks and the Gwembe District have now been investigated with special regard to their coal resources. . . . It seems likely that enough is now known regarding the cause and effect of coal formation in the Gwembe District to state that under the prevailing conditions, the formation of thick seams of coal must have been a rarity and the combination of circumstances which led to the deposition of the Wankie coal is unlikely to have been repeated elsewhere in the region".

A MINERAL RESOURCES POLICY FOR BRITAIN—I

The Nature of the Problem

By *JAMES F. McDIVITT*

THAT mineral raw materials are essential to the British industrial economy has been borne out by hard experience during years of shortage and high prices. That British consumption of mineral raw materials is equally vital to the economies of many mineral-producing countries is borne out by their problems during periods of over-supply and low prices. As we oscillate between these two extremes, on the one hand inadequate supplies, and hardship at home; on the other hand over-supply, and hardship in the countries which supply us; many of us wonder if indeed this is the best that we can do in our modern world. Inevitably, this leads us to consider the question of " mineral resources policy ".

Many men who deal with the problems of the mineral industry—men in business, government, trade organizations, education—are aware that something is missing, but it is something which concerns them in a marginal rather than a direct way. As in other such border-line situations, where a problem does not fall precisely within the area of responsibility of any existing group, it may be possible to generate interest, but there cannot be much action, as few people have the time or facilities to make a thorough study of the situation.

Normally one would expect such a study to be made by the government, but in Britain the government interest in the mining industry is split up into a series of poorly co-ordinated compartments, with the vital area of mineral resources policy as a sort of " no man's land " in the middle.

What is mineral resources policy? Do we need such a policy? If we need a mineral resources policy how can we get it? These are not new questions. However, they are questions which have never been answered sufficiently convincingly to lead to a thorough review of our basic thinking towards problems of mineral development and supply. Perhaps this is because there is no group charged with finding the answers, and perhaps an attempt to answer these questions here will clear the air somewhat.

In simplest terms, the mineral resources policy of a government is a reasoned and consistent attitude towards questions involving minerals, based on a running assessment of the continually changing part that minerals play in the economy of the country. All countries have a mineral resources policy, even if it is only to let minerals look after themselves, but this attitude is rapidly dying out in our complex society, and can be justified only in countries where the production and consumption of minerals has little effect on the economy.

The Exporting Countries

The basis and objectives of policy vary from one country to another, and, in countries which are advanced in their thinking on these problems, may vary from one mineral to another. The variation depends on whether the country is mainly a producer for domestic consumption and export (Canada would be a good example); a non-producer but important importer (Britain is in this class for the non-ferrous metals); or a producer which also relies heavily on imports (the United States).

Countries which are important producers and exporters of minerals would include Canada, Australia, many parts of

About the Author and His Subject

For a number of years *The Mining Journal* has been urging the need for a coherent British mineral resources policy and equally for the economic and technical intelligence services without which such a policy cannot be formulated. We were indeed discussing this problem in these columns as recently as three weeks ago in the context of Sir Ronald Prain's presidential address to the Institute of Metals.

It would be no exaggeration to say that over the years our exhortations have so far fallen on barren ground. Indeed, in our darker moments we have even wondered whether it might not be that after all everyone was in step but us. In an endeavour to reassure ourselves on this point, we have sought the views of Professor James F. McDivitt, who is both outside, and independent of, the domestic British minerals situation and who at the same time is well-qualified to express an opinion.

Formerly on the staff of the Mineral Resources Division of the Canadian Department of Mines, Mr. McDivitt has during the past four years been Professor of Geology at the University of Indonesia under the Colombo Plan and is currently spending a sabbatical year in Europe prior to taking up the Chair of Minerals Economics at Pennsylvania State University.

While in Europe Mr. McDivitt first accepted an assignment from the recently-formed British Mining Equipment Export Association to identify and report to the Association on the nature of British Government policy in relation to minerals, and to identify the various government and private organizations which were, or might be, concerned in formulating and executing such policy. More recently he has been, and still is, serving as a consultant to the European Productivity Agency of the O.E.E.C.

We have asked Mr. McDivitt to set down for *The Mining Journal*, in a short series of articles, both his conclusions as to the attitude of mind which he has found in Britain towards the responsibilities of government in matters relating to minerals, and also his assessment of the machinery which is already available, and/or may be needed, to provide intelligence services on these matters.

The first of these articles, which appears here, contains an analysis of what is meant by a mineral resources policy and seeks to relate this to the attitude to these problems which the author has found in Britain. Subsequent articles will aim first to identify the government departments and other agencies which at present maintain intelligence services relating to various aspects of the mineral resources problem, secondly to consider how far these intelligence services are adequate for policy making and finally to suggest how best to keep under continuing review the minerals policies which, by the nature of things, government (and indeed many private companies) must of necessity adopt, even if negatively by in fact doing nothing.

Both *The Mining Journal* and the author are indebted to the British Mining Equipment Export Association for permission to incorporate in these articles material which in part formed the basis of Mr. McDivitt's report to the Association on the same subject.

Africa and South America and, in Europe, Spain and Sweden. Policy in these countries should be designed to support and stimulate mineral development and production through making the economic environment favourable; to encourage local consumption where possible in order to build up a strong home market, thus cutting down on the dependence on foreign markets; to encourage local mineral processing so that as much as possible of the ultimate value of the mineral remains in the country; and to co-operate with business abroad in setting up an efficient marketing process to ensure stable markets, or at least to be able to anticipate market changes.

In Britain, the coal industry might fall into this group to some extent, and a review of the problems the British coal industry has encountered might point out the value of a well thought out long-range mineral policy based on adequate information on resources, production, consumption, stocks and trends.

Countries Dependent on Domestic Mineral Production —

In countries where domestic production is important, but must be supplemented by imports (the United States is the major example, but other countries such as France and Germany fall into this category for some metals), policy should aim at striking a balance between the interests of domestic producers and the need for continuing supplies from outside sources. Domestic production must be maintained on as high a level as is economically feasible, as it provides employment and new wealth. Domestic resources also have strategic value, so some emphasis must be placed on wise use, conservation, and research which will lead to a broadening of ore reserves, so that the domestic industry will be ready to step up production should foreign sources of supply be threatened by political or military action.

At the same time, since foreign supplies are also essential, and may become relatively more important over the years, encouragement, perhaps in the form of financial investment or long-term contracts, should be given to the development of foreign deposits in areas which are politically stable, strategically accessible, and other things being equal, where such commitments can have some foreign-aid implication through helping the economy of a friendly country.

In Britain, the iron and steel industry could be included in this category. This industry has a rather well developed policy, guided by the Iron and Steel Board and the British Iron and Steel Federation, which between them have admirable statistical and research facilities.

— And Those Dependent Largely on Imports

We come now to the countries which are highly dependent on mineral imports, and since we are in this group for most minerals, it will be discussed in some detail, with Britain in mind. Other countries in the category would be Japan, the industrial countries of Europe for some minerals, and all industrial countries in the case of the ores of aluminium.

The countries in this group are very vulnerable to changes in the pattern of mineral supply, for they have no developed domestic resources on which to fall back. They are doubly vulnerable, for in their hands the value of the mineral material is being compounded by processing. The raw materials pass through many stages, employing people and paying a return on invested capital at each stage, and any disruption of the supply pattern can bring the whole process to a halt. To make their position even more critical, they may not know when they are in danger, for being minor producers they have no tradition of mineral thinking, no national mineral consciousness, and so not only may they have no reasoned mineral policy, but they may have no information or experience upon which to base their thinking when periodic crises make some sort of policy imperative.

The mineral resources policy of these non-producing countries should be based first upon supplying their needs. A detailed knowledge and understanding of these needs, and an assessment of the changes in needs as indicated by changes in use patterns, and trends in such things as substitution, markets, and prices, both at home and abroad, is essential. Such knowledge, when translated into policy might point out the need to encourage research in the field of substitution to cut down on the degree of reliance on undependable sources ; it might advocate making special concessions in order to stimulate limited domestic production of strategic materials ; it might indicate the need to participate in the financing of some foreign development in order to be able to share in later production. We also should have as much information as possible about the size, grade, accessibility, etc., of the foreign resources on which we rely. All these actions are aimed at making the economy more secure in the future.

Policy must also pay special attention to the other side of the supply picture, for it is equally necessary to assess and give value to the part that large mineral purchases play in the economy of the nations which supply us. Mineral development is a very important aspect of aid to underdeveloped areas. Mineral purchases, especially on any sort of long-term contract, are a powerful economic and political weapon, and are used as such by many nations.

Example of the U.S. Bureau of Mines

Other areas which a mineral resources policy should cover, and which are inadequately covered in Britain can best be summarized by paraphrasing a section from the U.S. Bureau of Mines pamphlet " Mineral Facts and Problems — 1960 Edition "*. Major decisions in industrial development, foreign affairs, international trade, defence, and in many other areas, frequently require reliable and comprehensive information on the nation's mineral position. Government agencies responsible for conducting our foreign affairs as well as those charged with procurement of materials for defence and internal development, must know the country's mineral position. The elected government likewise depends on objective, authentic information so that its decisions can be based on facts. Perhaps most important of all is an informed private industry, because its agents make so many of the major decisions involving minerals.

All this is a far cry from the avowed mineral policy of Britain, as expressed by Lord Mancroft (Hansard Dec. 18, 1956) :

> " Our policy is perfectly clear. It is that we must have a maximum supply from the most economic source, whatever that source may be."

This policy based on total reliance on the market has the great administrative advantage that it is simple — no one can make a mistake, because no one makes any decisions. It works quite well during times of over-supply, if one can afford to ignore the economic repercussions in the producing countries. It was adequate during the long period when Britain, with strong Empire and Commonwealth ties, was participating relatively more actively in world mineral development than at present, but even the friendliest of the former colonies is no longer so exclusively reliant on us for capital, markets, equipment, engineers as it once was. As a policy it has been something of a failure during times of crisis, when normal trading is suspended, and we are left

* See *M.J.* of March 25, 1960, pages 351-2.

with no very clear idea of what we have, what we need, what we are going to need, and where we are going to get it.

In the United States the government supplies information to industry to help it make its decisions involving minerals. Our policy would seem to require that the government go to industry for the same type of information. This is a questionable procedure, for there must be serious doubt that the interests of industry are identical with the best over-all interests of government, particularly in the case of an international industry like mineral supply, no matter how sincere it may be.

Some Preliminary Conclusions

The argument in this article has so far been illustrative and general. Before going on to more specific matters it might be of value to summarize perhaps the main points which emerge from our preliminary examination of the problem :—

1. Mineral resources policy is a direction of thinking, a reasoned and consistent attitude towards problems involving minerals, aimed at achieving optimum use.
2. Mineral resources policy is government policy, and since government policy almost automatically leads to some degree of government control, the mineral industry cannot necessarily be expected to give it full and enthusiastic support.
3. The need for mineral policy varies from country to country depending on the part that minerals play in the economy. Since Britain depends heavily on imported mineral raw material, it is important that our policy be well developed.
4. Once a country has a mechanism for its own policy it may find some advantage in co-operating with other countries with similar problems, as in the O.E.E.C., or joining a group cutting across categories as any Commonwealth arrangement would do.
5. In Britain, when one talks of " mineral resources policy " it must be borne in mind that we have " coal policy," " iron and steel policy," and " non-ferrous metal policy," because for some reason, these minerals which have so much in common in nature are treated in different ways by the government.

Two other points have been assumed throughout the discussion, and since public thinking on minerals is rather archaic it may be that most people believe just the reverse to be true. First, the great problem of the world mineral

Review of Miner

ANCIENT remains in Iran confirm mining activities of the past by discoveries of metals, slags and furnaces. Metallurgy was advanced to the extent of preparing forms of brass and de-silverizing lead by the use of animal bones. Little recorded data on this ancient work is available but private enterprise at the present time in various parts of the country is reviving the old industry. Additional capital, experienced management and technical skills are required to develop further the mining industry.

General Geology. Pre-Cambrian rocks are rare in Iran but igneous rocks of varying age occur in many places. The most important were formed in Palaeozoic and Cretaceous ages, with lava flows important in large areas through Eocene to Pliocene times. Intrusives are associated with the major folds and are of granitic to gabbroic types; the extrusive rocks although not generally associated with mineralization often contain later epithermal deposits. The commonest form of hydrothermal deposits are epithermal copper, lead and zinc mineralizations in lavas and limestones. Porphyritic deposits are also known. Lead, zinc and antimony replacement deposits are known but are less common. In early Tertiary times basic intrusives were formed and large areas with chromite segregations are found.

Sedimentary deposits of coal are mainly Jurassic in age, gypsum and salt deposits up to recent age are very common.

Oil is thought to come from Mesozoic times, accumulating mainly in the Asmari limestones (late Eocene to Miocene) but also found in lower Cretaceous strata.

Iron Ore. There are seven iron prospects being worked with iron also known in other localities. On the contact of syenite and granodiorite three magnetite hills are found near Semnan. The Teheran-Meshed railway passes nearby but no studies have yet been made although samples of 60 per cent Fe with no phosphorus are recorded. East of Yezd around Bafgh an igneous complex contains several magnetite deposits which visiting German geologists recently estimated at 30,000,000 tons with 54 per cent Fe. Communications are exceptionally poor although the position is in the area north of the Kerman oal deposits.

A German mission has also studied the Shams-Abad iron deposit near Arak on the Teheran-Khorammshar railway. The geology is complicated, a mixture of replacement and hydrothermal genesis with hematite and limonite ore containing manganese, sulphur and silica. Possible reserves are 100,000,000 tons with 47 per cent Fe.

Other deposits are near Teheran; on the islands of the Persian Gulf (especially Faroor Island); and near Amol.

Other Minerals

Manganese. A total of five mines is reported. They are near Ardestan (north of Nain) and south-west of Teheran. Near Ardestan haussemanite occurs in andesitic rocks giving an ore of 54 per cent Mn, and has been exploited by several mines. At Robatkharim near Teheran on the Southern railway the veins are in a contact zone in sediments. The mineral is psilomelane with some metal oxides giving a 30 per cent Mn ore which can be upgraded to 44 per cent Mn. The mine is reported to need no exploration having a reserve of 100,000 tons with a further 500,000 tons shown by geophysical methods. The production is now 25,000 tons per year.

Chromite. This occurs in the north-east and south of the country, where a total of 65 mines, mostly very small, are recorded. The rocks run from Shahrud to Meshed (south of the railway line) in the north of Iran extending south to Torbat Heydrieh. Five mines in the west of this belt have reserves from 5 - 20,000 tons each but the bulk of the mines are centred around Sabsevar. The area in the south extends from Daulatabad on the road Bandar Abbas-Sirjan eastwards widening to over 200 kms. south of Bam. Four main mines are reported in this area with good metallurgical grade ore which is, however, more liable to contamination than the northern ore.

Tungsten is found near Arak. The Hassan-Abad mine is said to have reserves of 30,000 tons with 0.8 per cent tungsten consisting of scheelite with cassiterite, chalcopyrite and tourmaline.

industry is not one of inadequate supply — the mineral resources of the world are enough. The problem is rather one of efficient and effective development, pricing and distribution. Second, for most uses specific minerals are not essential. They can be replaced by other minerals or by non-mineral substitutes.

Need for an Advisory Panel

If we take as the situation (a) that minerals are produced in many countries at varying costs, (b) that they must be processed, transported, and sold, (c) that some countries produce, some consume, and some do both, (d) that the ultimate consumer uses minerals because there is nothing better at the price, (e) that the market for minerals is not stable either in total value of product, or in relative use of various materials, it will then be seen that the variables which affect policy become almost infinite. It must also be considered that they affect the policy of a multiplicity of government departments, quite as much as the private sector of the economy.

No one man can cover the range of material which must be considered. Thus we come back to the concept of the "Advisory Panel" which was advocated by the I.M.M. Symposium on Mineral Resources Policy in 1955. No group of men, however, could possibly have in their heads the vast amount of information on which an adequate policy must be based. Thus we need also a good and continuing information and statistical service.

Complete information should be available to the panel on as wide a geographic basis as seems necessary on such things as exploration trends, ore reserves and grades, production costs and problems, supply and use patterns, research activities, effects of changing technology, substitution. Such information should be analysed on a long-term and short-term basis. The results should be available not only to the panel, but should also be circulated both within and outside of the government.

To know our place in the mineral economy of the world this is what we should have. We fall short of it to the point that we have no Advisory Panel on mineral resources policy, and we have no bureau for mineral information and statistics. We do, however, have a number of separate and somewhat isolated groups working along the edges of the problems which might provide much of what we need if properly co-ordinated. To examine the function of these groups is the task of the next article.

rResources in Iran

This is a condensation of a lecture delivered by Dr. T. Ziai, Under Secretary for the Imperial Iranian Ministry of Industry and Mines, in Teheran in November, 1959

Lead and Zinc. There are over 100 mines of these metals, as ore with over 35 per cent Pb can be profitably exported from the country and some private mines are equipped with concentrating plant.

The usual occurrence is in hydrothermal veins of galena which is generally argentiferous. Mines are scattered over the country with one especially important area around Anarak (east of Nain) where cerusite and galena veins have been worked for thousands of years. Several furnaces are installed in this area. More mines are in the Isfahan area where zinc is also important and at Khomein near Arak a Franco-Iranian company exploits several mines and runs a 300-ton per day concentrator.

North of Tabas in the Central desert are several mines, some with concentrators. Other mines are found on the Caspian littoral, in the west near Zanjan, in the Teheran area and east of Yezd.

Copper. Surface deposits have been exploited, usually of chalcocite and chalcopyrite with some oxidation minerals. The most important areas are north of Anarak and in the Abbassabad region east of Shahrud. Near Anarak porphyritic ores of 3-5 per cent copper have been mined with nikeline associated which is smelted on the mines to speiss. Around Abbassabad the ore mined is 7 per cent Cu. The matte from both areas is refined near Teheran electrolytically. Other mines are known south of Sabsevar, around Isfahan, near Khazvin and in Zanjan and Hamedan. There are fifteen mines.

Antimony. There are four mines in the Hamadan and Ferdows areas. The Hamadan mines are epithermal veins in porphyry, steeply-dipping, averaging about 10 cms. width. After screening a 35 per cent antimony concentrate is produced.

Magnesite. This is mainly used for firebricks and is mined near Meshed, where 100,000 tons of 18 per cent magnesite is reported in the reserves. Other deposits are near Nain.

Coal. There are over fifty recorded mines. The Elburz area is the most important at present and five mines on the northern slopes of the Elburz are being modernized, their reported reserves being 10 - 40,000,000 tons each. Less well-known mines are found.

Sulphur. Occurs in Tertiary sedimentary rocks and, with the exception of one mine near Zanjan, the remaining seven mines are near Semnan. One mine has 200,000 tons of reserves and at present supplies the bulk of local needs.

Red Iron Oxide is mined on Hormuz Island where 10,000 tons is the annual production with 500,000 tons of reserves.

Turquoise is mined near Neyshapour about 6,000 kilos being produced annually.

Gold is reported in quartz veins around Khomeyn and alluvial deposits have been worked. A new mine near Golpayegam is on a granite/schist contact with gold disseminated in the area but this is only economic when in quartz veins. Ten dwts. is reported in vein gold with a reserve of 158,364 tons.

Legislation. Minerals are classified as building materials, metallic ores and oil and radioactive minerals, the last two being reserved for government exploitation.

Building materials are the property of the landowner who must obtain an exploitation permit himself, or be compelled to allow exploitation in return for a 3 per cent royalty.

The metallic minerals require first an exploration permit, which is available to anyone not already in possession of one, and covers a maximum area of 40 square kms. They are only available to foreign nationals with Parliamentary approval, except in the case of join stock companies. A report must be submitted to the Ministry of Mines at the close of exploration before an exploitation permit is given. This may be awarded on a tender basis to ensure maximum productivity, but if it is given to anyone other than the explorer, he is entitled to 1 per cent royalty on the gross product. The government is entitled to 4 per cent and the landowner 3 per cent royalties.

Narvik — the Modern Ore Harbour

NARVIK, situated 85 miles north of the Arctic circle on the Norwegian coast, is the biggest export harbour for iron ore in Europe. From 1903—when the railway to Narvik was completed—until 1958, about 225,000,000 tonnes of high-grade iron ore have passed through the chutes from the railway to ship holds in Narvik harbour. The ore is mined in Swedish Lapland under arctic conditions. The railway connecting the mines with Narvik has bottom-dumping cars with 40 tonnes capacity. The ore comes in several grades crushed to a maximum size of 10 in. (250 mm.) and in Narvik it is reduced to 4 in. (100 mm.) or to 2 in. (50 mm.).

Some years ago it was decided to replace the entire transport system in Narvik with a modern flow transport system based mainly on belt conveyors with new grab cranes over the stockpiles and with a new ore pier capable of receiving ships of modern size. This description of the new, modern ore harbour at Narvik is extracted from an illustrated brochure recently issued by A.B. Nordstroms Libanor.

The rebuilding of the ore harbour in Narvik was in the first stage designed for a capacity of the pier of 4,000 tons an hour. The second stage comprised rebuilding the storage facilities to extend capacity from 2,000,000 to 3,000,000 tonnes, and a mechanized system for handling the trains. The last link in the development was to be an increase of ore pier and total conveyor system capacity to 6,000 tonnes an hour. This increased capacity was also connected with the future increase in the export of the Lapland ore to 12,000,000 tonnes per annum through Narvik. The complete plant was designed to handle daily 18 ore trains, each consisting of 65 bottom-dumping railway cars.

The incoming trains are unloaded from four tracks. Two cars are emptied simultaneously through bottom gates into receiving hoppers. From these hoppers the ore is passed to roller grates with power driver rollers which feed it to four gyratory crushers which reduce the ore to lumps not exceeding 4 in. (100 mm.) in size. The roller grates at the same time act as a screening device permitting the smaller lumps to bypass the crushers. The ore that passes through the roller grates or is discharged from the crushers is collected in bins. These bins discharge the ore on to slat conveyors which in turn feed it at a variable rate to the belt conveyor system incorporating the conveyor bridge running through the middle of the storage area 75 ft. (23 m.) above ground and with a length of 2,650 ft. (810 m.).

On the conveyor bridge there are two reversible shuttle conveyors, one serving the right side and the other the left side of the stockpile. To each end of the shuttle conveyors a travelling bridge is attached. The bridge has a fixed conveyor and a reversible shuttle conveyor. By means of this conveyor system the ore can be placed anywhere in the yard and also spread over the corresponding surface. From the stockpiles the ore is lifted with the help of four bridge cranes, with a capacity of 1,000 tonnes per hour. The cranes can pass the conveyor bridges without interference. The grab weighs 35 tons and takes 18 tons at a lift. It unloads into pockets supported by the crane structure, whence the ore is fed on to two belt conveyors, one on each side along the stockpiles. These conveyors are coupled to the double conveyor system leading to the pier by means of two shorter intermediary conveyors. Ore can also be carried on switch conveyor through the old crushing plant for crushing down to 2 in. (50 mm.) size.

Automatic Sampling and Weighing

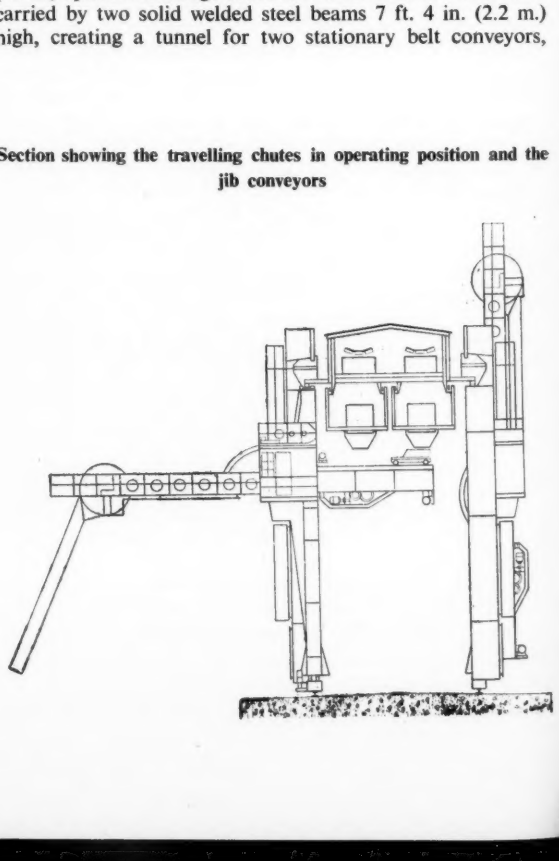
In the central building the ore passes through an automatic sampler. Ore which is cut out from the ore flow is crushed and sampled anew, so that on coming down to the first floor of the 6-floor building, the samples go to chemical analysis in which the percentages of iron, sulphur and phosphorus are determined. The quantity taken out for the crushing and sampling process is 0.5 per cent, which now amounts to 40,000 tonnes annually and will be 60,000 tonnes when the whole system is completed.

Before leaving the central building, the ore is weighed on four automatic scales which are placed in tandem, two and two on each belt. The weight figures are automatically registered in the operator's cabin at the loading berths.

The Ore Pier

Originally, there were plans to extend the old ore quay along the shore. However, it was found more advantageous to build a pier from which ships could be loaded from both sides, thus enabling two ships to be loaded simultaneously. This new pier projects 700 ft. (215 m.) from the shore and consists of a deck of reinforced concrete resting on steel columns going down to rock bottom. There is a concrete tower with a lighthouse at the pier head. This tower is connected with the central building by a bridge 840 ft. (255 m.) long, supported by concrete columns spaced 140 ft. (43 m.) apart. The bridge consists of a concrete roof and floor carried by two solid welded steel beams 7 ft. 4 in. (2.2 m.) high, creating a tunnel for two stationary belt conveyors,

Section showing the travelling chutes in operating position and the jib conveyors



each 600 ft. (180 m.) long. Running on rails under the floor are two reversible shuttle conveyors, each 275 ft. (84 m.) long. The shuttle conveyors unload on hinged jib conveyors, travelling on rails on the pier deck. The head of each jib carries an ore chute with which the ore flow can be directed. As the pier has a double conveying system, two kinds of ore can be loaded simultaneously.

From the longitudinal belt conveyors in the center of the pier, the ore is transferred to the holds with the help of three travelling chutes, two on the deeper side of the pier and one on the other side.

The jib belt in operating position can draw ore from either of the two shuttle conveyors under the main bridge. Thus two holds can be loaded simultaneously, one from the right side belt and one from the left side in the bridge.

View inside the conveyor bridge which has two belt conveyors

Feeders, Belts, Idlers and Drives

To load the ore smoothly on the belts, apron feeders of very sturdy construction with exchangeable manganese steel pans are installed under each hopper. These feeders not only regulate the ore flow but also give some protection for the belts against tramp iron.

The belts are 48 in. (1,200 mm.) wide and ¾ in. (19 mm.) thick. The ore is carried from crushing plant to ship by 7,500ft. (2,300 m.) rubber belts with a weight of 75 tons. The belts run on Nordström's patented unit idlers. These idlers can be exchanged and opened up for inspection very conveniently. Not only the ball bearing but the entire shaft is packed in grease, so that no rusting nuts or screws will prevent maintenance.

On most of the conveyors the driving machinery is Nordström's geared drums, which are driven directly from standard motors with V-belt drive. The gear boxes are enclosed in the belt pulleys, which saves space in conveyor tunnels. The gears run in oil and on roller bearings. All pulleys are supported by roller bearings.

Control and Safety System

The numerous conveyors, feeders, etc., spread out over long distances and connected with an extended system of wiring involves the possibility of losses in capacity due to delays caused by failures in the numerous electrical and mechanical parts. It has therefore been a principle of design to centralize control and safety arrangements. The safety arrangements are housed in the lighthouse tower at the pier head, where all movements are reproduced and through an electric system safeguarded against mishaps caused by wrong manoeuvres or other causes. In order to localize any defects in the system without loss of time, all wiring is brought into a control room on top of the head bridge. Here, too, all movements can be followed on a panel through lamps and indicators. If a failure should occur, the monitor can immediately localize it on the panel and direct an electrician or repairman to the right spot by telephone.

Each travelling chute carries an operator's cabin, placed at a height which affords the operator a free view over ship and hold. From this cabin the operator has complete control of conveyors, feeders, chutes and belts from crushing plant or yard until the ore reaches the hold. On a panel in front of the operator the movements of feeders, belts, chutes, shuttle conveyors, etc., are indicated. On the same panel the operator can also follow the tonnage passing to the hold. The cabin also has telephone connections with the ship and with various places in the conveying system. Thus the control of the entire conveyor system connected to a travelling chute is in the hands of one man.

In the summer of 1958 a third travelling loading chute on the pier started operation. At that time 65,000,000 tonnes of ore had been transported—28,000,000 tonnes on the lefthand belts and 37,000,000 tonnes on the righthand belts.

When the third loading chute was erected, the complete conveyor installation was inspected. The entire belt system was in first-class running condition with the exception of some small injuries from tramp iron on the two short feeder belts. The wear on the ¼ in. (6.3 mm.) rubber cover was barely discernible. One of the Nordström geared drum drives was taken apart and closely inspected in all details. All gears proved to be in the same condition as at erection.

Working conditions for the handling system at Narvik are not very favourable. The arctic location, quick changes in temperature, salt spray driven in with storms from the sea, ore frozen deep in big lumps, melting and freezing, dry and dusty fines or fines mixed with snow, have caused special design and maintenance problems. Snow storms have held up the supply of ore from the mines, but the Narvik ore pier has been reliable.

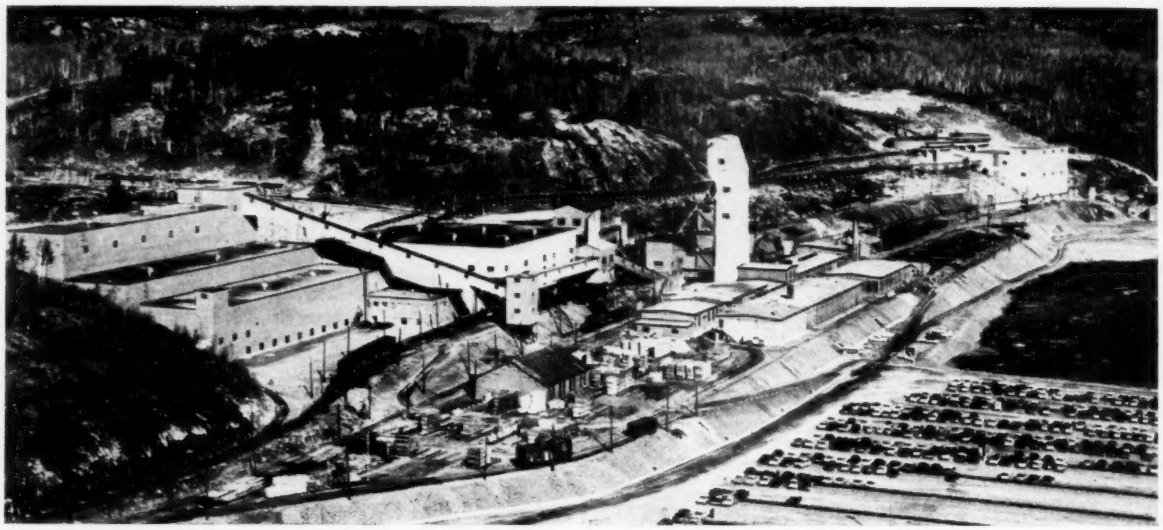
The Automatic Train Pushers

The last link in the mechanization of ore handling at Narvik is a system for handling the trains on the four tracks from which the ore stockpiles are fed. Handling the ore trains on their arrival at Narvik was previously a very complicated and costly operation. The ore coming from the mines is delivered in several grades, as the content of iron and phosphorus ranges between 60-68 per cent Fe and 0.02-3 per cent P. Each train contains sets of 5-6 cars of the same grade, which in Narvik were made up into larger sets of the grade required by the ship which was loading. Seven locomotives, several hundred railway cars and a considerable number of hands were continuously occupied with this work. Locomotives and train crews were also continuously working and signalling for every pair of cars to be unloaded.

A complete mechanization of train handling was finished at the beginning of 1957, when the four train pushers were put into operation. These pushers operate entirely automatically. Each of them consists of a powerful pusher which runs on guides in a tunnel under the tracks outside the dumping place. The pushers push the train forward with a " head " working on the car's steel frame just between the buffers, and thus feed the entire train a distance sufficient to get two cars into unloading position. The " head " returns under the track and then lifts again for a new push. The pushers' entire cycle of operation is approx. 120 seconds. Owing to limited track facilities the trains are now divided into two units for unloading.

In the future, however, it will not be necessary to break the train into units.

Highly Automated Mill in Sudbury, Canada



Inco's new Levack mill. Illustration shows the mill building and the sand plant built at the mine shafts

A NEW, highly automated ore milling plant has been opened by The International Nickel Co. of Canada, Ltd. in the Sudbury area of Ontario. This is the latest step in a continuing programme to counter rising costs with increased production efficiency through technological advances.

The modern mill, located at Inco's Levack mine and built at a cost of $12,000,000, makes extensive use of instrumentation to permit centralized, and in some cases automatic, control of the crushing, grinding, flotation, and dewatering processes involved in the production of concentrates from ore. All operations are controlled from centrally located instrument panels. Many recently developed techniques, such as the use of radioactive isotopes for making density measurements, have been incorporated into the new plant.

The mill is among additions and improvements the company is carrying out at its properties in the Sudbury area which, with the new nickel mining project being developed at Thompson, Manitoba, will raise Inco's nickel production capacity to 385,000,000 lb. per year by 1961. The Levack installation brings to three the number of ore milling plants operated by Inco at its nickel mines in the Sudbury area, the Free World's greatest source of nickel.

The Operational Sequence

The Levack mill has a capacity of 6,000 tons of ore per day. Crushed ore from the Levack mine No. 2 Shaft is conveyed directly into a concrete silo-type bin with a live capacity of 3,000 tons. Two parallel conveyors feed the coarse ore to two 7-ft. cone crushers which reduce it to minus three-quarters of an inch in size. The crushed ore is then conveyed to three large circular concrete bins with a storage capacity of 16,000 tons. A special screening process removes the wood chips *en route*. Automation is used to assist in this crushing operation. The crushers, crusher oil pumps, screens, variable-speed ore feeders and conveyors are all operated and controlled from a central instrument panel where lights indicate what equipment is in service. The occurrence of trouble in operational equipment sounds an alarm on the control panel and gives a visual indication of the trouble. An indicating and recording weightometer on the panel shows the tonnage of ore being crushed.

Use of Selective Flotation

The two grinding units each consist of a 15-ft. rod mill, a 14-ft. ball mill, and two cone classifiers. A central instrument panel controls the entire grinding operation. Weightometers automatically control and record the rate at which ore is fed into the grinding units. Water addition to the rod mills is adjusted from the panel. In the cone classifiers the density of the overflow to flotation is measured and automatically controlled by radioactive isotope instruments which regulate the water addition to the classifiers. The selective flotation process used produces a nickel concentrate, a copper concentrate and a rock tailing. Flotation process variables such as pulp density, temperature and alkalinity, are automatically controlled by instruments located on a central panel.

The flotation concentrates are dewatered in thickeners followed by vacuum filters. The operation of the thickeners and filters is automatically controlled through instruments on a central panel on the filter floor. The thickener underflow pumps and filtrate pumps are remotely operated from this panel. More than thirty railway cars of nickel and copper concentrates are shipped each day to the Inco smelters at Copper Cliff and at nearby Coniston. The flotation tailings are pumped 1,500 ft. to the sand plant where approximately 85 per cent of the tailings are recovered as sand fill for use in the mine. This fill material is sent by pipeline directly into the mine.

MINING MISCELLANY

Gorny Zhurnal, a Soviet monthly, devoted the main part of a recent issue to difficulties encountered at Russia's largest bauxite deposit. The deposit, in the northern Urals, has been exploited for the last 25 years. The bauxite reaches a depth of 1,500 metres, but in places is covered by heavy overburden. So far it has been worked mainly by opencast and shallow shafting. The journal adds that the technical problems connected with the exploitation of the deeper levels of the north Urals bauxite deposits are nowhere near solution.

British manufacturing industry spent approximately £300,000,000 on research and development in 1958, compared with about £190,000,000 in 1955. This represents 4.2 per cent of manufacturing industry's contribution to national production compared with 3.1 per cent in 1955. Items noted in the expenditure returns during the year under review showed development costing £64,000,000 on electrical engineering and £43,000,000 on chemicals. These and other statistics are contained in a DSIR survey on "Industrial Research and Development Expenditure, 1958" published last week by HMSO at 1s. 3d.

★

Bray Construction Equipment have entered into an arrangement with the West German firm of Klöckner & Co., for the marketing of the Bray range of tractor shovels. Bray tractor shovels have been shown at the German Construction Machinery Exhibition in Munich and at the German Industry Exhibition at Hanover. Bray tractor shovels exported to Germany will be fitted with the air-cooled Deutz-Dieselmotor, an engine which is incorporated in more than 90 per cent of all construction machines in Germany. This is the first British shovel to be powered by a German diesel engine. The three models available will be the 450T with a 72 h.p. Deutz 4 cylinder air cooled diesel engine, having a lifting capacity of 7,300 lbs; the 455T powered by a 90 h.p. Deutz 6 cylinder engine, having a lifting capacity of 8,000 lbs; and the 460T model with a 108 h.p. Deutz 6 cylinder diesel engine. This latter model has a lifting capacity of 12,000 lbs.

★

The Swedish Luossavaara-Kiirunavaara AB (LKAB) has announced that it is shortly to commence experimental production of 300,000 tonnes of iron ore in the southern part of the Kiiruna deposit at Leveaniemi. Reserves of this ore—known as Svappavaara ore—with its 50 per cent iron content, are put at 100,000,000 tonnes. Completion of the experimental mining scheme, which will use opencast techniques, is expected by the end of the year.

★

A study of the chrome ore deposits located in the Kemi area of Finland is to be terminated at the end of May next, when a decision will be taken whether the 15,000,000 tonnes reserves of low-content chrome ores could be exploited economically. Concentration of the high-iron, low-chrome mineral might solve the problem.

A total of 6,000,000 forints is to be spent on the search for non-ferrous metal ores in Hungary during 1960. Principal areas for exploration are in the Matra district, where orebodies lying from 20 to 100 metres below ground level are hoped to be located at Matraszentimve, Nyirjes and Paradsavar, where lead, tin and copper are being sought. Further exploration for lead-zinc ores will be in the Valencei mountains near Patka and Pakozd.

★

Mineral production in British Columbia increased by 5 per cent, in 1959, largely as a result of Japanese orders. Last year Japan bought less than 1,000,000 tons of iron ore, but hopes to double purchases in 1960. 770,000 tons of coal have been ordered. Shipments of copper concentrates are steadily increasing, and a contract for 8,000 tons of nickel concentrates has been re-negotiated for a larger tonnage over a three-year period. Sumitomo Shatji Haishi is reported to be considering a loan of $7,000,000 to Bethlehem Copper Corporation.

★

After eighteen months of exploration, costing $U.S.200,000, Minerales Industriales del Peru reports finding rich phosphate deposits in the Sechura desert, stated to be of high quality, and in sufficient quantity to supply export as well as domestic needs.

★

Plans are being completed for the Mitsui Mining Co. of Japan to co-operate with Thiess Bros. of Australia to form a new company to develop the rich Kianga coal in Queensland. The plans, now awaiting formal approval of the Japanese and Australian authorities, include a railway line of 100 miles to the port of Gladstone. Kianga coal deposits are estimated at 1,000,000,000 tons, and Thiess Bros. report that Mitsui Co., have placed firm orders for coal totalling 1,000,000 tons in 1961, rising to 3,000,000 tons a year by 1964. At present Japan imports 700,000 tons of Australian coal a year, mainly from New South Wales.

★

Recovering zinc from the large slag dumps at Broken Hill Associated Smelters, Port Pirie, has received attention for a considerable time, and it has now been announced that a plant is to be erected, using a new type of blast furnace, at a cost of £A2,500,000. A coke works costing £A750,000 is to be constructed using coal from the South Coast collieries of New South Wales. The slag dumps have accumulated from the smelting of Broken Hill lead concentrates since 1896. Water for the extended enterprise will be pumped from the Murray River through a duplication of the existing pipeline about 250 miles long.

★

According to figures released by the Soviet Central Statistical Administration, the Soviet Union produced 129,000,000 tons of coal during the first quarter of 1960, an increase of 2 per cent over the same period of 1959, and 13,800,000 tons of coke, an increase of 6 per cent.

Two German geologists are surveying tin reserves on Bangka Island, off South Sumatra, under the economic and technical co-operation programme between Indonesia and West Germany. A previous survey had shown that tin layers on Bangka contained additional minerals some of which are greatly concentrated and their exploitation and processing should start shortly.

★

More than 150,000 signatures are claimed by sponsors of a drive in the U.S. for a price of $105 an ounce for domestically mined gold. The campaign was started by John R. Ross, chairman of American Gold Association Inc.

★

The Belgrade agency, *Tanyoug*, reports that Yugoslavia is to increase industrial production in the next twenty years, so as to have a 1980 output of 3,900,000 tonnes of bauxite annually, and 500,000 tonnes of aluminium. 1960 output of aluminium is to be increased to 24,000 tonnes, some 10 times the 1951 output, and bauxite output up to 812,000 tonnes, compared with 250,000 tonnes in 1951.

★

The Stora Kopparbergs Bergslags AB of Sweden, together with the Finnish Concern Oy Vuoksenniska AB is to form a joint subsidiary under the name of Oy Koverhar AB to produce phosphorus-free pig-iron. The 1,000,000,000-Finnmark company will open a plant at Koverhar near the Finnish parent-company's iron ore mines. Annual pig-iron capacity, which will go to the processing plants of the Swedish company, will be some 250,000 tonnes. The electro-furnaces at the Kopparbergs plant at Domnarvet will be closed when the Koverhar plant comes into production.

★

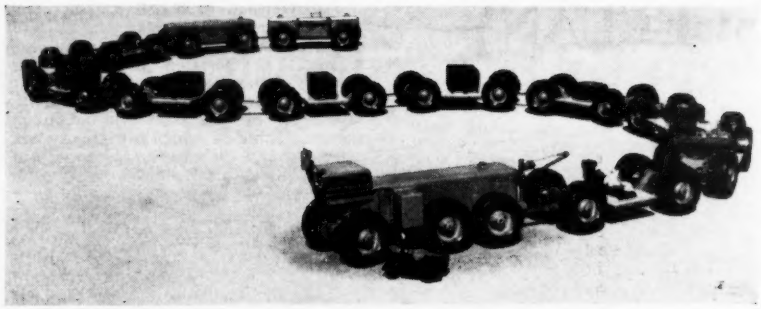
It is announced from Oslo that the 300-year old copper mines at Roros will have exhausted their known ore deposits in about ten years, and the future of the concern is to be decided by aerial prospecting.

★

A new company has been formed in India, Pyrites and Chemicals Development, with a capital of 50,000,000 rupees, by the National Industrial Development Corporation of India, for the exploitation of pyrite deposits in the Amjor district of Bihar. The pyrites will be processed into sulphuric acid and other sulphur derivatives. A Norwegian expert has studied the deposits and is to advise on exploitation and processing of the pyrites. Investment needed for the sulphur plant, which will have an estimated initial daily output of up to 300 tonnes of sulphur, is over 60,000,000 rupees.

★

Cominform help for Chinese mining schemes continues. Bulgarian aid in the form of planning equipment and trained personnel has been used in the opening of a new lead-zinc mine in the Kuangshi area of south China. In the Fushun coalfields of Chinese Manchuria, a mine for the opencast exploitation of oil shale begun in 1957 has now been completed; here planning was by Russian experts and equipment supplied from Czechoslovakia.



A new type overland train that rides on 54, 10 ft. high rubber tyres has gone into production, according to a recent announcement by R. G. LeTourneau, Inc. It will be the U.S. Army's largest rubber-tyred land vehicle and will consist of 130 cars and will be 560 ft. in length. Although details of this specific application have not been revealed, completion of the multi-unit carrier obviously provides a cargo vehicle capable of operation in remote areas over varied terrain where supply routes are long, fuel supplies limited and roads non-existent. There is thus an obvious application in mining of all types. The illustration above shows a model of the train, which is indicative of the increasing swing away from rail transport

Péchiney last year produced some 144,530 tonnes of aluminium as compared with some 139,000 tonnes in 1958. Aluminium sales (domestic) rose by 9 per cent over the year and exports by 17 per cent; exports now account for 30.5 per cent of the company's aluminium sales. Record production was reported in the fields of ferro-chrome, ferro-titanium and magnesium, due to increased demand from foreign buyers in particular. The Péchiney plant for the production of nuclear graphite started last year supplies to the second reactor of the Electricité de France being erected at Chinon. At the end of last year the company took over the thorium and rare earths installation of Produits Chimiques de Terres Rares in La Rochelle. The Fria subsidiary, which exploits a bauxite deposit in Guinea and processes the bauxite to alumina, is to make her first alumina shipment from Conakry this April.

Personal

Mr. D. C. Hanley has been appointed assistant managing director International Harvester Co. of Great Britain Ltd. as from April 1, 1960.

★

Sir Ronald L. Prain, chairman of the Rhodesian Selection Trust Group of Companies, has relinquished the chairmanship of the Management Committee of the Copper Development Association after 10 years in that office. He has been succeeded by Mr. E. C. Baring, a director of the Anglo American Corporation of South Africa Ltd., and vice-chairman of the Council of the Association of which Sir Ronald will remain chairman.

★

Mr. D. J. C. Small, associate member I.M.M., has been awarded the Atlas Copco Organization bursary, the purpose of which is to enable a young mining engineer to carry out a six-weeks study tour of Swedish mines.

★

Mr. W. F. Cartwright will be inaugurated on May 3 1960, as president of the Iron and Steel Institute for 1960-1961, in succession to Mr. W. Barr.

Company News

British Ropes Ltd. have completed negotiations with the New Zealand Government to set up a wire ropery in Auckland to supply the major part of the domestic needs of New Zealand for wire ropes. A new factory is to be built and the company will supply an already established sales network throughout New Zealand.

★

AEI-Birlec have issued a new edition of "Dry Pneumatics", publication No. 709, for distribution at the Compressed Air and Hydraulics Exhibition at Olympia April 25-29, giving details of their new range of refrigeration dryers for compressed air applications.

★

British Geon announce that work will shortly begin on a £2,000,000 extension to their polyvinyl chloride plant at Barry, South Wales, making their eighth extension during the thirteen years of the PVC plant's operation. British Geon is jointly owned by The Distillers Co., (55 per cent) and B. F. Goodrich Chemical Co. of America (45 per cent.)

★

Hattersley (Ormskirk) have appointed Markland Scowcroft to be stockists of Hattersley gun metal and cast iron valves.

★

Pantak have concluded an agreement with Sierex of London for the marketing and servicing of the Siemens 15 meV Industrial Betatron.

★

The British Association of Corrosion Engineers has been elected a member of the European Federation of Corrosion. The object of the Federation, which is a non-profit making union, is to promote European co-operation in the field of research on corrosion and methods combating it for the benefit of the community at large. Membership of the Federation is restricted to non-profit making European technical and scientific societies. The address of the hon. sec. is 97 Old Brompton Road, London S.W.7

Coming Events

The second Alexander Redgrave Memorial Lecture, organized by the Institution of Industrial Safety Officers, will be delivered at the Royal Society of Arts, April 26, 2.30 p.m., by Mr. A. G. Palmer, Design Office Manager of the North Thames Gas Board, on "Design and Use of Clearance Certificates".

★

The twelfth Annual General Meeting of the Cornish Mining Development Association will be held at the Camborne School of Mines on April 27, 7.30 p.m.

★

The Institution of Mining Engineers announce the following fixtures:

The Institution's Summer Meeting will be held at Cardiff, June 29, 30 and July 1. On June 29, 11.0 a.m., Lecture by Mr. J. M. Rogan on "Pulmonary disability among coal miners, with special reference to the Pneumoconiosis Field Research"; and at 2.30 p.m., lecture by Mr. G. V. Standerline and Dr. S. Islwyn Evans on "The degradation of coal in power-loading".

★

Manchester Geological and Mining Society are holding their Summer Meeting on June 9.

★

Midland Counties Institution of Engineers are meeting on May 18, at Ashby-de-la-Zouche, for a lecture by Mr. S. A. McKee on "The application of the Monoveyor at Donisthorpe colliery".

★

The Midland Institute of Mining Engineers are holding a meeting at Sheffield on May 5, for a lecture by Mr. F. Fairclough on "Fast-moving Faces".

★

The Mining Institute of Scotland will hold their 82nd Annual General Meeting on May 28 in Glasgow.

★

The North of England Institute of Mining and Mechanical Engineers will meet at Newcastle upon Tyne on June 9, for a lecture by Professor E. L. J. Potts and Mr. F. F. Roxborough on "The influence of percussive action on the ploughability of coal seams."

★

The South Staffordshire and Warwickshire Institute of Mining Engineers will meet at Lichfield on May 10, for a lecture by Mr. J. V. Spence on "Some observations on the behaviour of discharged air from pneumatic-stowing ranges and ventilation ducts."

★

An Ordinary General Meeting of The Institution of Mining and Metallurgy will be held on Thursday, June 16. Purpose of the meeting is to discuss three papers published in the April 1960 issue of the Institution's *Bulletin* dealing with the geochemical anomalies related to beryllium and its detection and assay.

★

Interplas 61, the sixth International Plastics Exhibition and Convention will be held at Olympia from June 21 to July 1, 1960.

Machinery and Equipment

New Self-Powered Wheel

The motorized wheel now developed by International General Electric, is self-powered and is completely self-contained and requires no other mechanical power connections. It can be used for openpit mining, and where rough terrain prohibits the use of conventional vehicles.

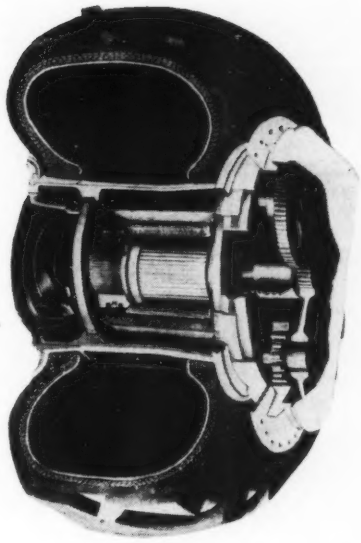
The motorized wheel makes possible a 125 tons gross weight hauler combining high performance and large capacity while having the manoeuvrability of a vehicle one-third its size.. The secret of its versatility is found within the wheel hub where a few relatively simple parts, an electric traction motor and a few gears, give the wheel its driving force. Current for the electric motors of a vehicle powered with motorized wheels is supplied from a diesel engine-driven generator, or power may be supplied to the motors from a direct-current overhead trolley. Each wheel can develop 380 h.p. at the rim, giving a total of 1,520 h.p. for a vehicle having four of these wheels.

Should the motorized wheel on one side of the vehicle lose traction in loose mud or snow, the amount of current supplied to those wheels is automatically decreased and the amount of current fed to the wheels that have good purchase is increased.

Another built-in advantage of the motorized wheel is the positive and powerful braking system which it provides. Travelling at top speed—35 m.p.h. —a motorized wheel vehicle can bring itself to a complete stop within a distance three times its own length. This can be accomplished with no strain on the brakes, because on deceleration the motors act as generators powered by the forward momentum of the vehicle. Then, the electric power generated by the driven motors is dissipated as heat in resistors. This dynamic braking system acts on the same principle as the dynamic braking systems used on many diesel-electric and electric railway locomotives.

A motorized wheel vehicle requires no transmissions, axles or differentials since each wheel contains its own power-producing elements. With fewer working parts, two further advantages are revealed: (1) lower maintenance costs and more maintenance-free working days; (2) more useful work per fuel unit input because less fuel is wasted as friction in transmitting torque from the engine to the wheel rims.

A prototype motorized wheel vehicle recently demonstrated its great potential power. The prototype, which had a gross loaded weight of 110 tons with the vehicle itself weighing 55 tons, was designed for hauling iron ore and handled 15 per cent grades fully loaded, and turned in only a few feet more than its own length.



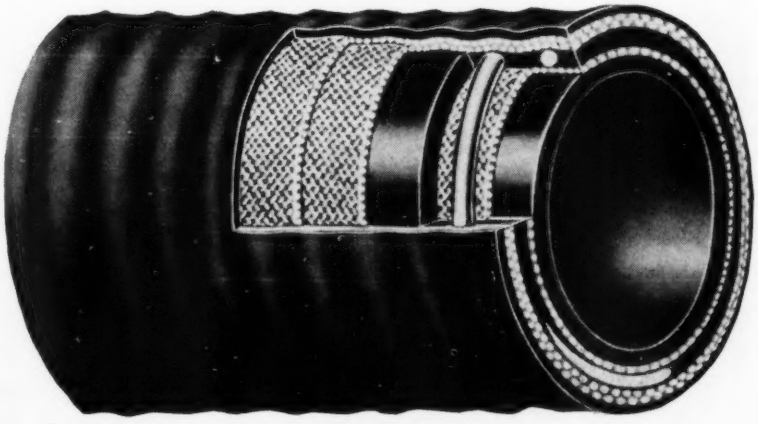
The motorized wheel by International General Electric Co.

RANGE OF CENTRIFUGAL PUMPS

The new Pegson-Sultan pump is a vertically split end suction, single stage, centrifugal pump. It is being produced in sizes from 1½ in. to 12 in. suction branch dia., the entire range comprising 42 pumps with capacities from 20 to 3,500 g.p.m.

Basically, there are six sets of constant hydraulic shapes around which all Pegson-Sultan pumps are designed. Each set of shapes produces a uniform performance pattern so that a 12 in. pump for example, is a pure geometric enlargement of any other model in the same hydraulic group. By keeping the suction eye constant for all pumps of the same suction branch diameter it has been possible to reduce the number of parts and increase interchangeability, e.g. although there are six 4 in. pumps in the range, one size of wear ring is common to them all. Furthermore the horse-power range—from ¼ to 75 h.p.—is covered by five bearing housing groups and, within each group, all shafts, seals, bearings, caps, keys and H.D. bolt locations are common. The advantages afforded by the features mentioned in this paragraph can be seen more clearly if one compares the new Sultan range with a range of 42 pumps in which none of the major components is interchangeable; the latter would involve some 1,250 parts; the Pegson-Sultan range has only 254 such parts.

The new Goodyear dry materials hose, Style 273 x 243



NEW DRY MATERIALS HOSE

Goodyear has just added to its range of industrial hoses a lightweight, flexible hose specially built for the bulk handling of dry materials which are not highly abrasive. The new hose is particularly well suited for the handling of dry chemicals in crystal powder form, and similar materials. The smooth uniform bore of the tube and its substantial thickness of abrasion-resistant rubber ensure maximum capacity and service.

The Goodyear Dry Materials Hose (Style 273 by 243) is supplied in lengths to suit the site and application. It can be built with enlarged ends for fitting couplings or with soft ends for clipping to existing pipework or hopper feed tubes. The seamless 3/16 in. smooth-bore tube of high grade rubber is reinforced by three plies of strong, close woven fabric and a helix of round, steel wire embedded in the rubber whilst the cover consists of a medium-gauge abrasion-resisting compound.

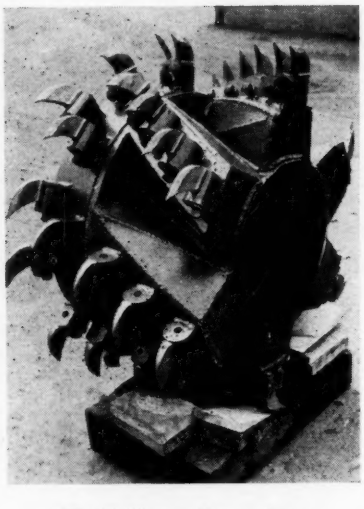
The hose has a maximum working pressure of 50 p.s.i. and is supplied in bore sizes of 2½ in. and 4 in.

COAL NEWS

Mine winders with a total value of nearly £475,000 are to be suplied by the Heavy Plant Division of Associated Electrical Industries Ltd. to collieries in South Wales, Scotland, and Yorkshire.

At Bedwas Colliery, in the Coal Board's South-West Division, two double-drum winders, one of 2,600 h.p., the other of 2,400 h.p., will be installed, the d.c. motors will be supplied by mercury-arc rectifiers.

The Scottish order is for two tower-mounted multi-rope a.c. friction winders for No. 3 Shaft, a new shaft, at Cardowan Colliery, near Glasgow. The wind-



The Robinson shearer drum

ers, which will operate balanced cages will be driven through epicyclic gears by 1,050 h.p., 750 r.p.m. motors.

One winder will raise 189 tons of coal an hour from a depth of 2,040 ft; the hourly output of the other will be 243 tons, from a depth of 1,428 ft.

The mechanical parts of the Bedwas winders will be manufactured by M. B. Wild & Co. Ltd., and those of the Cardowan winders by John Wood. W. H. Allen, Sons and Co. Ltd. will supply the gearboxes for the Cardowan winders.

The third order is for a 2,100 h.p. geared a.c. winder for "A" Shaft, at Lofthouse Colliery. This winder, which will also be used for winding men and material, is designed to raise a net coal load of five tons at 40.2 ft./sec. from a depth of 1,098 ft.—a continuous hourly output of 350 tons. The existing winder drum will be used. Braking of the co-ordinated compensated type will be provided. Robey and Co., Ltd. are supplying the mechanical parts.

The electrical equipment for Cardowan Colliery will be manufactured at Rugby, as will the rectifiers for Bedwas. The motors and control gear for Bedwas and Lofthouse will be manufactured at Trafford Park, Manchester.

FABRICATED CUTTING DRUM

Further news in the British coal industry is that a fabricated drum designed to replace the standard cutting drum of the Anderton Shearer Loader has been designed in Area 7, East Midlands Division. Anderton machines fitted with the Robinson drum are in use at several collieries in the Division.

The drum consists of a number of pockets, on the periphery of which pick boxes are mounted. Two rows of pick boxes are provided at the face side of the drum to give a close pick sequence on the four inches nearest to the coal-face. The rest of the drum has a special semi-helical pick lacing and the drum is cut away between these helical rows of picks to form pockets: these pockets allow large coal to pass freely round the drum and also prevent recirculation.

Use of the Robinson drum has increased operating speeds and reduced power consumption compared with the conventional drum.

Compressed Air – Hydraulics Exhibition

The first International Compressed Air and Hyraulics Exhibition is being held in the Empire Hall, Olympia, from April 25-29, 1960. It is of interest that 54,000 tickets have been requested and that over 30 countries are represented by the large contingent of overseas visitors.

Among the exhibitors whose products are of particular interest to the mining industry are Joy-Sullivan Ltd. and Maxam Power Ltd.

The Joy - Sullivan Air Power Division was formed last year to manufacture a range of air compressors and pneumatic tools and this exhibition is the first public showing of these products. Although new to Britain this equipment has been developed in, and manufactured for some years by, Joy - Sullivan's parent company in the United States.

The principal exhibit is a W.N. 112 industrial stationary compressor — a two-stage double - acting water - cooled compressor of V-vertical design. The machine shown is powered by a flange-mounted electric motor and is one of a range available offering capacities from 400 to 853 c.f.m. free air delivered at 100 p.s.i. Low pressure models are also available operating at 60 p.s.i. with proportionately larger capacity.

Rotary vane type portable compressors are represented on the stand by the RP - 600 Airvane and the RP 365, these machines delivering 600 c.f.m. and 365 c.f.m. at 100 p.s.i.g. These compressors are available with a choice of Cummins, Rolls - Royce or General Motors diesel engines. RP.250 a diesel - driven rotary portable compressor which has recently gone into production will also be shown. This is a "four-tool" machine which is expected to arouse considerable interest amongst contractors and plant hire operators.

A medium-weight Joy-Sullivan UW. 181 wagon drill mounting a Joy TM.350 drifter is another exhibit.

Hand - held pneumatic equipment will also be available for visitors' inspection on the stand. These will include the Joy Speedline rock drills, L.37 and L.47 and the Speedline concrete breakers K.61 and K.81.

Principal feature of these machines is the exclusive Joy dual-valve designed to admit exactly the right amount of air to each end of the piston to drive it back and forth at exactly the right time, preventing the live air from softening the blow by shutting off the supply at the end of each stroke. This device offers a considerable reduction in the air consumption generally associated with this type of tool.

The Joy 47 rock drill on show is basically the same as the hand-held type but is provided with Airleg mounting.

A selection of single-drum hoists makes up the balance of exhibits.

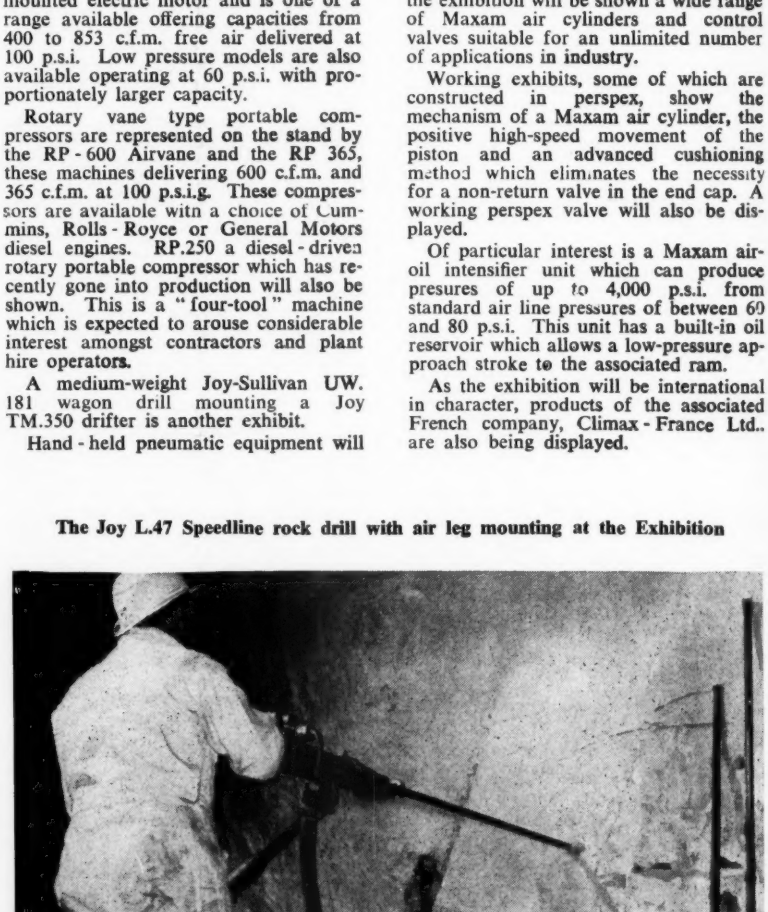
The improvement of production techniques is the *raison d'être* of a company like Maxam Power Ltd., a member of the Holman Group, and on its stand at the exhibition will be shown a wide range of Maxam air cylinders and control valves suitable for an unlimited number of applications in industry.

Working exhibits, some of which are constructed in perspex, show the mechanism of a Maxam air cylinder, the positive high-speed movement of the piston and an advanced cushioning method which eliminates the necessity for a non-return valve in the end cap. A working perspex valve will also be displayed.

Of particular interest is a Maxam air-oil intensifier unit which can produce presures of up to 4,000 p.s.i. from standard air line pressures of between 60 and 80 p.s.i. This unit has a built-in oil reservoir which allows a low-pressure approach stroke to the associated ram.

As the exhibition will be international in character, products of the associated French company, Climax - France Ltd., are also being displayed.

The Joy L.47 Speedline rock drill with air leg mounting at the Exhibition



Opencast Mining And Concentration Produces Iron Ore in Ontario

Some 15 miles north of Capreol, Ontario, Canada, an opencast mine and concentration plant has recently been put into operation.

The plant employs about 160 men and working a 20 shift week is expected to produce 550,000 tons annually of concentrated iron ore. By the use of two layers of corrugated steel and a layer of fibreglass insulation the plant is to be kept in operation throughout the year.

Actual location of the ore is at Moose Mountain. Prospecting has revealed 11 deposits of iron core in the Mountain. At the present time the deposit being mined is approximately 5,000 ft. long, the width varying between 100 and 600 ft. Where the ore outcrops vertically in the form of a hill advantage has been taken of the small amount of overburden to remove the ore as economically as possible.

With the overburden cleared away, conventional vertical drilling is carried out. Between 45 and 50 holes are drilled for each blast which produces between 35,000 and 40,000 tons of the low-grade iron ore.

Large electrically powered shovels load the rock after blasting into 22 ton capacity trucks which carry the raw ore to the primary crushers.

The Concentration Process

Primary crushing is carried out by a 66 in. and 84 in. jaw crusher, which is one of the largest of its kind. After passing through the primary crushers the ore is reduced to below 8 in. dia. and is then carried by a 42 in. wide conveyor belt to a 100-ton capacity storage bin over the secondary crushing units.

From this storage bin the ore passes on to a 54 x 84 in. vibrating feeder and then on to a 6 x 12 ft. screen. Ore below $\frac{5}{8}$ in. dia. is taken straight to a silo at the concentrator building. Above this size the iron ore goes to a 7 ft. core crusher and then to the tertiary crushers.

Storage of the reduced ore is in three 3,450 ton silos at the concentrator plant. The ore is now less than $\frac{1}{4}$ in. dia. and in this size it is passed into the concentration plant. First it is automatically weighed and the weight recorded on a chart. The iron content of the ore is also recorded. On the average the iron content is doubled by concentration from approximately 35 per cent to about 65 per cent.

The process of concentration roughly speaking consists of grinding the iron ore and water down to a very fine slurry and then removing the iron-rich particles by magnetic means.

Final product is a fine dewatered material which can either be used with low-grade untreated ores or else alone. In the latter case the use of this richer material makes it possible to obtain a greater pig-iron output from the same blast furnace capacity, an important factor because of the high cost of blast furnace construction.

Metals and Minerals

Aluminium in the Shipbuilding Industry

Seldom does a week pass without reports of the further extension of aluminium's rapidly widening markets. The latest, and by no means the least interesting, concerns the increasing use of aluminium in the Japanese shipbuilding industry. In North America shipbuilding still remains a virtually untapped field for aluminium. The Japanese, however, are apparently taking the lead in the utilization of this metal for major marine applications.

Since 1950, when the Ishikawajima Co. broke virtually new ground by using approximately a ton of aluminium alloys in the Daio, a vessel under construction for the Marine Safety Agency, substantial new and expanded aluminium applications have been noted in ship construction in Japanese yards. According to the *American Metal Market*, probably the largest amount utilized was in the "Sunwalker", a bauxite ore ship built at the Uraga yards for the Saguenay Terminal Co. of Canada and used in transportation of materials for Aluminium Ltd.'s aluminium complex. More than 180 tons of aluminium was used in the superstructure, hatch covers, funnel, mast, lifeboats, etc., of this ship.

Aluminium is now being used by Japanese shipbuilders for virtually all types of marine vessels, whether for Japanese or other ownership. Apart from structural areas such as superstructures, funnels, radar masts, deck house assemblies, deck plates, bridge ladders, lifeboats, etc., its use has been extended to interior equipment. The Committee for Shipbuilding lists the following as being among the most common applications: Desks and tables, chairs, lockers and chests of drawers, oil and water tanks, lamps and brackets, gyro stands, engine telegraphs and stands, compass stands, radar equipment housings, depth recorder equipment and door hardware.

Here, clearly, is a market which must offer immense potentialities for aggresive development in other countries besides Japan.

The same journal also gives an illuminating insight into aluminium's growing importance in defence. Although in the U.S. only about 4 per cent of current consumption goes into direct defence applications, it has been estimated that, if indirect uses are included, from 12 per cent to 14 per cent of all applications have a bearing on defence.

Aluminium's relative lightness, in comparison with many other metals, becomes increasingly important in view of the present trend in military production towards missiles, airborne equipment and ground mobility. For example, the U.S. Army is developing an entire family of lightweight weapons which includes the Mechanical Mule, the M-113 armoured carrier, the M-60 tank, and the M-56 gun motor carriage. The Mule weighs less than 1,000 lb. but can carry more than its weight in men and equipment; the M-113 weighs only 9 tons but has the same fire-power and carries the same load as the 20-ton vehicle it is intended to replace. The M-60 will use more than 150 aluminium components aggregating about 3 tons per vehicle; the M-113 about four tons, and the M-56 about 1,500 lb.

The advent of the Jet Age has not led to a reduction of aluminium demand for aircraft, as was once anticipated in some quarters, but it has contributed to the development of better and stronger alloys. It has been estimated that a reduction of a pound in the structural weight of a missile provides an additional 18 to 20 miles in altitude or lateral range. Actual uses of aluminium vary by missile from a pound or so to a couple of tons. Examples quoted include Mighty Mouse, 2 lb. of aluminium out of a total weight of 19 lb.; Falcon, 49 lb. out of 100 lb.; Redstone, 4,500 lb out of 40,000; Vanguard, 3,700 out of 22,500; and the Matador, 5,000 lb. out of a total of 14,000 lb.

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According to Mr. Stanley Osborne, president of Olin Mathieson, the price increased announced by major U.S. aluminium producers last December is not sufficient to offset the rising costs. However, this year Olin Mathieson's own affiliates will consume about 75 per cent of the company's aluminium production.

Mr. Osborne also disclosed that on April 20, Fria, the international consortium organized by Olin and four European companies for the production of alumina from bauxite reserves in the republic of Guinea, would make its first shipment. This shipment will go to the Swiss partner, Aluminium Industries A.G.

NIOBIUM AND RARE EARTHS IN STEEL

At the annual meeting of the Molybdenum Corp. of America the prisident and chairman, Mr. Marx Hirsch, referred to a number of significant developments in the use of rare earths and niobium in steel making. Tests during the year, he stated, have shown that the addition of rare earths to certain tonnage steels permits the production of quality steel ingots weighing up to 64,000 lb. — approximately double the weight obtainable by present normal practice. Several large steel companies are currently making extensive plant-scale commercial runs utilizing rare earths to produce such ingots. Mr. Hirsch added that he would be very disappointed if in 1961 the steel industry did not use 4,000 to 5,000 s.tons of the rare earths.

It was further reported that the use of niobium as an additive to produce a new line of fine grained mild carbon steels with 50 to 100 per cent greater strength had been established during 1959 in the automotive, gas transmission and machinery industries. These steels, permitting weight reductions up to 35 per cent in some applications, are claimed to be less expensive than competing grades of commodity steels.

The Molybdenum Corp. has two niobium orebodies described as being

among the largest known in the world; one at Oka, Quebec, in which Kennecott has a joint interest, and the other in Brazil where Molybdenum has a joint interest with a privately-owned U.S. metals company. The South American property averages about 3½ per cent niobium oxide content that will be mined by open pit methods. Designs are now being made for the construction of a 200 t.p.d. capacity mill at the Brazilian property.

U.S. MANGANESE STATISTICS

Preliminary figures issued by the Bureau of Mines, U.S. Department of the Interior, indicate that general imports of manganese ore amounted last year to 2,442,183 s.tons and of ferro-manganese to 204,672 s.tons. The corresponding figures for 1958 were 2,452,578 and 170,712 s.tons. Domestic mine shipments fell to 225,000 s.tons in 1959 from the previous year's figure of 323,108. Total consumption of manganese ore during last year is given as 1,602,830 s.tons and at the end of the year stocks at plants (including bonded warehouses) totalled 2,254,648 s.tons.

Imports came from over 20 countries, the largest suppliers being Brazil (497,605 s.tons, manganese content), India (174,714) and Ghana (137,369).

CUBAN NICKEL EXPORT DUTY

U.S. Government officials have stated that no indication had been received in Washington that Cuba planned to apply its 25 per cent nickel export duty to shipments from the Nicaro plant owned by the U.S. Government. The export duty has been placed on shipments of ore made by private companies in Cuba. The Nicaro plant is operated by the General Services Administration on behalf of the U.S. Government. Representing an investment of about $80,000,000, the plant has been offered for sale, and the Cuban Government has expressed a general interest in purchasing it. It has been officially stated that GSA intended to go ahead with its normal monthly shipments of nickel ore from the Nicaro plant to the U.S.

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Mr. Leo A. Hoegh, director of the Office of Civil and Defence Mobilization, has been asked to review his ruling of October, 1959, that imports of cobalt were not threatening to impair the national security. The request was made by Rep. Gracie Pfost (Dem., Idaho), who noted that "forthcoming Cuban production" had been listed as a source of cobalt to meet domestic requirements. Noting that the new Cuban mining law had resulted in the closing of Freeport Nickel's nickel-cobalt mine and concentrating plant at Moa Bay, Mrs. Pfost asked Mr. Hoegh if he felt a revision of his cobalt estimate was warranted and, if so, to what extent U.S. domestic cobalt production should be resumed.

MAGNESIUM PRODUCTION RISES

Net shipments of magnesium mill products rose last year in the U.S. by 12 per cent over the 1958 volume, amounting to approximately 11,000 s.tons as compared with 9,350 s.tons for 1958.

COPPER · TIN · LEAD · ZINC

(From Our London Metal Exchange Correspondent)

Over the Easter holidays there has been very little activity in the metal world, the only interesting news being the rise in the Belgian copper price at the end of last week from the equivalent of approximately 31¼ c. per lb. to the equivalent of approximately 32.45 c. per lb. New York or Antwerp. This rise was brought about by the rise in the London settlement price.

Contrary to most expectations, the Copper Institute's figures for March showed that world production remained at approximately the same rate as in February whilst deliveries were also not very much higher. The actual figures for inside the U.S. were—production of refined copper 129,758 tons as compared with 105,417 tons in February with domestic deliveries totalling 122,752 tons against a February figure of 111,851 tons and stocks of refined copper at the end of the month showed a reduction at 61,598 tons against 64,007 tons at the end of February.

Outside the U.S. the production of refined copper was 172,195 tons as compared with 164,535 tons in February; deliveries to consumers totalled 181,723 tons as compared with 168,805 tons and end-of-month stocks amounted to 239,192 tons as compared with 238,344 tons at the end of February.

The copper market has also been maintained by reports that the negotiations in Chile between Anaconda and El Salvador are running into difficulties and there is now the possibility of a strike commencing on May 1.

There has been no news at all with regard to tin, zinc and lead and there has been little change in price in the first two but the latter has shown signs of firmness with the backwardation being well matained. The Eastern price of tin was equivalent to £787¼ per ton c.i.f. Europe.

Closing prices and turnovers appear in the following table:

	April 13 *Buyers*	*Sellers*	April 21 *Buyers*	*Sellers*
COPPER				
Cash	£264	£264½	£268½	£268¾
Three months	£243½	£244	£248½	£248¾
Settlement	£264½		£268½	
Week's turnover	8,825 tons		8,275 tons	
LEAD				
Current ½ month	£76⅞	£77	£77⅜	£77⅝
Three months	£76¼	£76½	£76⅝	£77
Week's turnover	6,900 tons		5,175 tons	
TIN				
Cash	£787	£787½	£7[illegible]8	£788½
Three months	£784½	£785	£783½	£784
Settlement	£787½		£788½	
Week's turnover	490 tons		605 tons	
ZINC				
Current ½ month	£92	£92½	£92¼	£92½
Three months	£89	£89¼	£8[illegible]¾	£90
Week's turnover	4,700 tons		3,900 tons	

LONDON METAL AND ORE PRICES, APRIL 21, 1960

METAL PRICES

Aluminium, 99.5%, £186 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £190 per ton
Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 10s. 6d. lb.
Cerium (99%) net, £16 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt, 12s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 5d. per gram
Gold, 249s. 10d.
Iridium, £23/£25 oz. nom.
Lanthanum (98%/99%) 15s. per gram.
Manganese Metal (96%/98%) £275/£285
Magnesium, 2s. 2¼d./2s. 3d. lb.
Nickel, 99.5% (home trade) £600 per ton
Osmium, £22/£24 oz. nom.
Osmiridium, nom.
Palladium, Imported, £8 12s. 6d.
Platinum U.K. and Empire Refined £30 5s.
Imported £28½/28¾
Quicksilver, £70½/£71 ex-warehouse
Rhodium, £45/£48 oz.
Ruthenium, £16/£18 oz. nom.
Selenium, 50s. 0d. per lb.
Silver, 79½d. f. oz. spot and 78⅞d. f'd
Tellurium, 21s. 6d. lb.

ORES AND OXIDES

Antimony Ore (60%) basis		19s. 6d./21s. 6d. per unit, c.i.f.
Beryl (min. 10 per cent BeO)		230s. per l. ton unit BeO
Bismuth		30% 5s. 0d. lb. c.i.f.
		20% 3s. 3d. lb. c.i.f.
Chrome Ore—		
Rhodesian Metallurgical (semifriable 48%)	(Ratio 3 : 1)	£15 5s. 0d. per ton c.i.f.
" Hard Lumpy 45%	(Ratio 3 : 1)	£15 10s. 0d. per ton c.i.f.
" Refractory 40%		£11 0s. 0d. per ton c.i.f.
" Smalls 44%	(Ratio 3 : 1)	£13 5s. 0d. per ton c.i.f.
Baluchistan 48%	(Ratio 3 : 1)	£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10 : 1)	Nb_2O_5 : Ta_2O_5	175s. per l. ton unit c.i.f.
Fluorspar—		
Acid Grade, Flotated Material		£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2)		156s. 0d. ex. works
Lithium Ore—		
Petalite min. 3½% Li_2O		47s. 6d./52s. 6d. per unit f.o.b. Beira
Lepidolite min. 3½% Li_2O		47s. 6d./52s. 6d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O		75s/85s. per ton f.o.b Beira
Magnesite, ground calcined		£28 0s./£30 0s. d/d
Magnesite Raw (ground)		£21 0s./£23 0s. d/d
Manganese Ore Indian—		
Europe (46%-48%) basis 67s. 6d. freight		73d./75d. c.i.f. nom.
Manganese Ore (43%-45%)		69d./71d. c.i.f. nom.
Manganese Ore (38%-40%)		nom.
Molybdenite (85%) basis		8s. 11d. per lb. (f.o.b.)
Titanium Ore—		
Rutile 95/97% TiO_2 (prompt delivery)		£28 0s. 0d. per ton c.i.f. Aust'n.
Ilmenite 50/52% TiO_2		£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)		147s./151s. per unit c.i.f.
Vanadium—		
Fused oxide 95% V_2O_5		8s./8s. 11d. per lb. V_2O_5 c.i.f
Zircon Sand (Australian) 65-66% ZrO_2		£16/£16 10s. ton c.i.f.

Mining Finance

Rhodesia Broken Hill's £3,000,000 Scheme

With the Rhodesia Broken Hill annual report are the promised details of the money-raising to finance the installation of the new Imperial Smelting furnace and ancillary plant at this lead and zinc property. The estimated cost is £4,350,000. This includes additional housing and a further generator at the Lunsemfwa hydro-electric station. Of this amount, £400,000 has already been spent and the company has another £400,000 in hand from 1959 profits. This leaves £3,550,000 of which it is proposed to raise £3,000,000 leaving £550,000 to be financed from future earnings.

Of the £3,000,000, only half is to be called for straight away. This is to take the form of an offer to stockholders registered on May 19 of £1,300,000 6½ per cent Unsecured Redeemable Notes 1966-70 at par in the ratio of £1 Note for every ten 5s. stock units. Anglo American Corporation is taking up a further £200,000 Notes, also at par. The second £1,500,000 will be covered by options attaching to the Notes entitling the holder to subscribe in June, 1962, for two Ordinary 5s. shares at 10s. each for every £1 of Notes then held. Anglo American Corporation is to underwrite both the Note and share issue. Additionally, it is to grant R.B.H. loan facilities of up to £1,500,000 until June, 1962, in case some of the money to be raised by the share issue is in practice needed earlier.

DIVIDEND PROSPECTS

This seems to be a satisfactory enough scheme. There will be no increase in the equity during the period while the new plant is being installed. So the chairman, Mr. Harry Oppenheimer, hopes that it will be possible to maintain the 1959 dividend rate of 9d. net of Rhodesian tax. After the new plant is in operation it is expected "materially to increase" dividends. Early-1962 is the target date for completing the plant.

Output should subsequently be not far short of doubled. Zinc production is planned at about 50,000 tons per annum against 28,895 tons in 1959 and lead at 28,000 tons against 14,400 tons. It is officially estimated that the life of the property on this expanded output basis will be about 25 years. There should, of course, be a saving of costs with the new process. R.B.H. currently stand at 9s. to yield 8.3 per cent. They were up to 12s. earlier this year. They have drifted back owing to fears generated by the African racial situation. On intrinsic merits they look very reasonably valued. An extraordinary meeting to consider the necessary increase in the authorized capital is called in Salisbury, Southern Rhodesia, on May 12.

ANOTHER MOUNT ISA SCRIP ISSUE

Mount Isa Mines, which is controlled by the American Smelting and Refining company, proposes to make yet another free scrip issue. This time it is to be one 5s. Australian stock unit for every three held. It follows one for ten in 1957 and one for eight in 1958. It involves the capitalization (in Australian currency) of £2,374,891 which is to be met from the company's Assets Revaluation Reserve amounting to £2,300,000 and the rest from the Stock Premium Account which stands at £324,189. It will bring the issued capital up to £9,499,565. And the market capitalization at 48s. (the ex scrip issue equivalent of the current London price of 64s.) would be £91,000,000 sterling.

Stockholders in Mount Isa have no reason to be other than very happy with their previous share bonuses because the value of their holdings has steadily appreciated. For instance, when the last issue was announced in October, 1958, the price of the units was only 25s. 6d. The yield, especially to a British investor who loses a fifth of the dividend when converted into sterling, was then tiny. It still is. Because the company paid only 1s. 3d. Australian for the year to June 30, 1959, while its interim for 1959-60, now announced, is merely being maintained at 6d. The new shares will not rank for this but they will for the final due next September.

By the end of June Mount Isa will have spent some £30,000,000 on its huge expansion programme which has added a valuable copper production to its lead and zinc output. And the scheme is not yet at an end. Both the copper smelter and the refinery are being expanded to a capacity of 60,000 tons of metal per annum. Eventual target is 100,000 tons. The Mica Creek power station is being brought up to a 60 MW capacity. A second haulage shaft is to be sunk at the mine. A plant for rolling copper rod and drawing wire is being installed. When the Townsville-Mount Isa railway has been rehabilitated, a task that is now being undertaken by the Queensland Government, Mount Isa plans to raise its production from the current 8,000 tons of ore per day to 14,000 tons. So, all in all, stockholders will probably still be content to view their holdings as very much of the long-term growth variety and thus will not worry too much about the small current return on their money.

GENERAL MINING PAYS MORE

General Mining, the South African mining finance house that has as its main interest substantial investments in the Union's newer gold mines, had in consequence another better year in 1959 and has once again raised its dividend. The final of 5s. on the £1 shares makes a total of 7s. against 6s. for 1958 and 5s. for 1957. The higher distribution absorbs just over £1,000,000 of a net profit of £1,916,008 which is £189,183 more than in the preceding year. A sum of £189,589 against £150,592 is utilized for writing down investments and other assets while £679,924 is transferred to revenue reserves bringing these up to £5,493,000. In 1958 these reserves received considerably more at £1,395,390, but £845,390 of this stemmed from the special profits made from the

LONDON MARKET HIGHLIGHTS

Since the Easter Holiday, South African Gold shares have been steady at their depressed levels. No further shock news was reported from the Union and encouraged by the failure of the strike call issued by the African National Congress some modest Cape buying neatly balanced the dwindling Continental offerings.

Local investors were still reluctant to re-enter the Kaffir market, but at least sentiment improved following news of the forthcoming talks between the South African Government and U.N. Secretary General, Mr. Hammerskjold. Disagreements within the Cabinet were emphasized by Mr. Sauer, a senior S. African minister, who spoke to his constituency of the need for restoring overseas faith in the Union and for "an important change in the practical application of apartheid". These views were subsequently repudiated by Mr. E. Louw, who insisted in the House on Wednesday that the government's policy remained basically unchanged.

Price movements were usually confined to a few pence either way. Free State Geduld fluctuated around 136s. 3d. and on hopes of a new record monthly profit West Driefontein crept up to 163s. 9d. Shares of the older mines remained in particularly short supply and the appearance of an occasional buyer was quickly reflected in Marievale (26s. 3d.) and Geduld (57s. 6d.) among others.

Brightest spot in the Finance group was provided by General Mining which advanced to 100s. following the higher profits and long-awaited increase in dividend. In Diamonds, De Beers see-sawed between 145s. and 140s. while the Cape bought and the Continent sold.

Copper shares still seemed a rather unhappy section. Continental sales of the Rhodesian issues continued—admittedly on a small scale—despite the latest rumblings of labour unrest in Chile. Rhodesian Selection Trust eased back to 12s. 4½d. and Chartered at 79s. 9d. remained at around their lowest this year. Tanganyika Concessions (32s. 6d.) were not helped by the unchanged interim. This company's most important source of income stems from a holding in Union Miniere, the Belgian Congo copper producer, and it had been hoped that the latter's increased final dividend would be reflected in the "Tanks" interim.

Tin shares remained quietly responsive to the growing tide of good news from the Malayan companies. The Gopeng offer for Tekka was received with general satisfaction, Gopeng rising to 21s. 9d. and Tekka to 8s. 9d. Terms of the offer were 2s. 6d. in cash for each Tekka share plus three Gopeng units for every ten Tekka held. Malayan (25s. 6d.) announced a sharp increase in permitted sales output for the March quarter which showed that the company's new Kampong Gajah dredge is getting well into its stride. A steady climb to a high of 75s. 6d. in Ayer Hitam reflected a persistent demand from the East.

Another particularly firm spot was in Mount Isa. The market—particularly in Australia—welcomed the news of yet another scrip issue by raising the A5s units to a peak of 66s. That the yield is now barely 1.5 per cent failed to deter buyers.

investment sales to the American-South African Investment company.

Providing the South African gold industry pursues the even tenor of its way—so far it has done so despite the country's racial disturbances—General Mining's earnings should keep up in 1960 and the 7s. dividend should at least be maintained. The shares have improved to £5 since the announcement and after allowing for the final dividend in the price, but not for double tax relief, the yield is 7.2 per cent. Pre-crisis price was £7¼.

ARISTON'S 20 PER CENT AS FORECAST

When last year's new share issue was made the chairman of Ariston Gold Mines, Mr. C. J. Burns, forecast a dividend on the increased capital of not less than 20 per cent on the 2s. 6d. stock units. The payment for the year to last September is now brought up to this amount with a final of 10 per cent, although the interim was actually on the capital as it was before the issue. An interim of 10 per cent, however, is also declared for the current financial year. The 1958-59 distribution absorbs £147,656 out of a net profit of £231,163 which compares with £242,800 in the preceding year. The company writes £42,731 off ore development expenditure and puts £30,000 to property and mine development replacement reserve leaving the carry-forward £10,776 higher at £198,543.

According to the monthly and quarterly reports, Ariston has made a good start to the present financial period from its Ghana gold property, working profit in the first half thereof having totalled £308,000 against only £238,000 in the first six months of 1958-59. The dividend might thus even be increased in due course. Meanwhile, at 4s. 6d. cum both final and interim the units offer a yield of 11.7 per cent.

"TANKS" INTERIM DISAPPOINTING?

There was some market disappointment with the mere maintenance of the Tanganyika Concessions interim dividend at 1s. 6d. per 10s. stock unit. This was understandable in the light of last week-end's announcement by Union Miniere, the Belgian Congo copper producer, of a final dividend of 1,000 francs making a total of 2,200 francs for the calendar year 1959 against 1,500 francs for 1958.

Its holding in Union Miniere is one of "Tanks" principal sources of revenue. The 46 per cent increase in revenue from that company's higher dividend, all of which will fall in "Tanks" financial year to July 31 next, thus makes it a virtual certainty that the latter's earnings for 1959-60 will be well up.

The Board, headed by Captain Charles Waterhouse, can, however, hardly be blamed for caution at this particular stage. The Belgian Congo is scheduled to achieve independence on June 30. By the end of September when "Tanks" final dividend is due to be decided upon, Union Miniere will have been operating under the new governing regime for three months. Too little time, perhaps, to see which way this particular cat will finally jump, but anyway some idea may have emerged by then as to whether or not Union Miniere will be allowed to carry on unhindered.

In other words, if all goes well "Tanks" should pay a higher final. In the meantime, the units have fallen to 32s. at which the yield on last year's total dividend of 3s. 9d. is 11.7 per cent, a measure of the market nervousness over the future of the Congo.

Technical Briefs

New One-Step Fused Salt Bath Electrolysis Process

A new one-step extraction process has been developed at the U.S. Bureau of Mines Laboratories, Reno, for separating tungsten from its impurities to produce commercial grade tungsten and molybdenum powders suitable for alloying. Bureau researchers successfully tested scheelite and obtained 98 per cent molybdenum and better than 99 per cent tungsten.

Scheelite concentrates mixed with alkali phosphates or borates are subjected to heating and low-voltage currents and make a cathodic deposit of molybdenum. Subsequently under increased voltage the tungsten is deposited from solution on a second cathode.

Principal advantages to the process are relative simplicity of plant, high current efficiency, reuse of electrolyte possible, and modest electrical requirements.

PREPARATION OF RARE EARTH CHLORIDE SOLUTIONS

U.S. Bureau of Mines *Report of Investigations 5540* describes a chemical process for preparing solutions of trivalent rare earth chlorides from sulphate solutions obtained by treating bastnasite concentrate. The chief impurity in the final solution is cerium, and this element is less than 1 per cent of the rare earth oxides. The solution is used directly in the separation of rare earth elements by ion-exchange methods.

The attractive features of the process are that the chemicals are inexpensive and the steps few.

The process starts with precipitating the rare earth hydroxides from sulphate solutions with caustic soda. After the hydroxides are dried to oxidize the cerium, they are treated with dilute hydrochloric acid to dissolve away the trivalent rare earth elements, leaving the tetravalent cerium. Details for controlling the leaching step are described. The process shortens older procedures by omitting the usual oxalate or double-sulphate-precipitation step.

The cerium in the acid residue is purified by double precipitation as basic nitrate, and the final precipitate is ignited to a 99.9 per cent cerium dioxide. Any trivalent rare earth elements remaining in the first basic nitrate filtrate are collected by precipitation with caustic soda, and the hydroxides are returned to the main process.

A main overall objective of the Bureau's research programme on rare earth elements is to make ultrapure individual rare earth metals and compounds and to determine some of their properties — properties that are not yet known or not well defined. Recognition and definition of characteristics of a rare earth element will create new interest in it and eventually lead to new uses.

Ultimately, research and development must provide the basic knowledge for obtaining marketable products from ores of rare earth metals. One of the most important ores contains minerals of bastnasite (a fluocarbonate of rare earth metals of the cerium group). Cerium can be separated easily by chemical means, but the other rare earth elements are so nearly alike chemically that chemical separation is tedious; and a different technique, such as in ion-exchange separation, is necessary. Removal of cerium chemically before application of the ion-exchange step is advantageous because: (1) Cerium comprises over half of the rare-earth-element content of bastnasite; and (2) chemical processing is faster and more economical.

The starting sulphate solution was prepared by treating bastnasite concentrate with sulphuric acid, and it contained the equivalent of 50-60 gm. of rare earth oxides per litre.

Essential steps of the method are as follows: (1) Conversion of rare earth sulphates to hydroxides; (2) filtering, drying, and heating the hydroxides to oxidize the cerium; (3) leaching the trivalent rare earth hydroxides away from the hydrous ceric oxide; (4) obtaining pure cerium dioxide from the acid residue; and (5) recovering trivalent rare earth elements found in the leach residue. Although experimental work has not gone far enough to define conditions precisely, a procedure has been established that gives a solution of rare earth chlorides and pure cerium dioxide.

URANIUM TREATMENT PLANT

The treatment plant at the Mary Kathleen uranium mine in the Cloncurry-Mount Isa district of Queensland has been described recently.

The orthodox acid leaching process is employed, using conventional crushing and fine grinding equipment, agitation in turbo mixers with sulphuric acid at a pH value of 1.7 to 1.8 and ground manganese ore as an oxidant for about eight hours, followed by counter current decantation, washing, ion exchange and finally alkali precipitation.

All liquid-solid separation is by 5-stage decantation and repulpers between each stage ensure thorough mixing whilst Separan is also added to each thickener to promote flocculation and yield a clear overflow. Clarification is carried out using Eimco "precoat" rotary filters and the ion exchange columns are eluted with the Porter chloride technique and the uranium precipitated with finely ground caustic magnesia.

AMALGAMATED COLLIERIES OF SOUTH AFRICA LIMITED

(Incorporated in the Union of South Africa)

Increased Profit

The following is an extract from the statement by the chairman, **Mr. T. Coulter,** which has been circulated with the annual report and accounts :—

The gross profit on coal mining was £714,228 (£616,055). Dividends received amounted to £347,547 (£345,505) and income from trade investments, interest, rents, sundry revenue and profit on realization of investments to £49,852 (£43,088). Total revenue was £1,111,627 (£1,004,648).

After deducting administration expenses £40,528 (£40,488) and provision for taxation £198,200 (£158,500) there remained a net profit for the year of £872,899 (£805,660).

Capital expenditure amounted to £18,470. There were, however, capital recoupments of £39,848 — including a liquidation dividend from Largo Colliery Company Limited of £37,592 — so that there was a net credit of £21,378 on capital account for the year. An equivalent amount was accordingly transferred from funds appropriated for capital expenditure to the credit of the appropriation account. The adjusted unappropriated profit of £313,726 (£281,569) brought forward with the net profit for the year and the sum of £21,378, referred to above, resulted in a total of £1,208,003 (£1,087,229) to be dealt with in the appropriation account.

The additional profits earned by the company's directly operated collieries—an increase of £70,460 at Cornelia Colliery and £27,713 at Schoongezicht Colliery—together with a small increase in dividends received from subsidiary companies and interest earned, made it possible to increase dividend payments by 3d. per share to 4s. 6d. for the year, which absorbed £699,750. An amount of £100,000 was again provided for future capital expenditure, the total now being £300,000, leaving £408,253 to be carried forward to 1960. This is an increase of £90,485.

Current assets, excluding stores, at £1,206,613 exceeded current liabilities, including provision for taxation, by £356,041.

Directly-Operated Collieries

CORNELIA COLLIERY: For the second year in succession this colliery achieved record sales output, the total for 1959 of 3,860,390 tons being an increase of 11,200 tons on sales in 1958. During July 1959, a record output of 395,448 tons was produced and sold.

The gross mining profit was £525,853, an increase of £70,460 compared with the previous year.

Power station trade was 20,729 tons less than in 1958 and local Vereeniging trade was down by 43,472 tons. Sales for domestic and general purposes showed an increase of 75,401 tons.

Last year I referred to work which had started on a new shaft to provide additional ventilation and a travelling way for certain of the more remote areas mined from the Betty Shaft. This new shaft—the Maccauvlei shaft—was completed early in 1959 and during the year connections were made underground in the shaft area. These have materially improved mining conditions.

Consideration is now being given to the question of exploiting the coalfield's deep area which lies between the Old Cornelia and Betty Shaft workings on the north and the Bertha Shaft workings on the south side. This so-called "Valley Area" lies between two down-throw faults, and it is hoped to arrange the allocation of workable ground so that one-half will be mined as part of the Betty Shaft field, with the other half mined from the Bertha Shafts.

SCHOONGEZICHT COLLIERY: This colliery produced 894,826 sales tons of coal, a decrease of 13,335 tons on the output for 1958.

Profit for the year increased by £27,713 to £188,375. The increase in profit reflects for the full year the increase of 1s. 3d. per ton in the price of coal authorized in November, 1958.

Subsidiary Companies

SPRINGFIELD COLLIERIES LIMITED: The company again had a satisfactory year, with a sales output of 2,163,535 tons, an improvement of 81,314 tons compared with 1958. Over 98 per cent. was despatched to the Klip power station under long-term cost-plus-profit contract.

Net profits for the year, after taxation, were £231,514, a small decrease of £2,336 compared with 1958.

Associated Companies

BLESBOK COLLIERY LIMITED: The company's entire output is reserved for the South African Iron and Steel Industrial Corporation Limited and is sold as blend coking coal. Total sales, at 633,562 tons, were 20,897 tons more than in 1958. The company earned a profit of £113,293 after taxation, which is £3,852 less than in 1958. Dividend payments were maintained at 9d. per 5s. share.

NEW LARGO COLLIERY LIMITED: Sales for the financial year ended June 30, 1959, amounted to 1,233,671 tons, a decrease of 38,930 tons compared with the previous financial year. Net profit after taxation was £158,749, a comparable drop of £5,715. Dividend payments were maintained at 10d. per 5s. share.

WITBANK COAL HOLDINGS LIMITED: The net profit, after taxation, was £21,501 compared with £21,143 in 1958. Dividends paid amounted to 2s. 3d. per £1 share.

General

Throughout 1959, there was a noticeable decline in the general demand for coal.

In the case of the company's operations, and as a result of the steady demand at Escom's power stations, and increased requirements of coking coal, the grand total sales from its directly-operated collieries, its subsidiary and its associated collieries were actually slightly higher by 23,240 tons than the previous year as is shown in the following tabulation :

	1959 Sales tons	1958 Sales tons
Cornelia ...	3,860,390	3,849,190
Schoongezicht ...	894.826	908,161
Springfield ...	2,163,535	2,082,221
Blesbok ..	633,562	612,665
New Largo ...	1,221,371	1,298,207
Totals ..	8,773,684	8,750,444

The year 1959 was characterized by a considerable improvement in the supply of trucks by the South African Railways. As a result of this improvement the Government decided to reduce the levy of 10d. per ton to 5d. per ton. The levy was removed entirely at the end of 1959, but notwithstanding this a fair amount of coal is still being moved by road.

Native labour is still plentiful and the prospects of full requirements being met in 1960 are very promising.

Working costs still show a tendency to rise and the increase of 1s. 3d. per ton granted in November, 1958, is showing a narrower margin of benefit to the industry.

The total Union output of coal for 1959 was 39,193,271 tons, a decrease of 747,005 tons compared with 1958. However, a proportion of this decrease can be accounted for by the fact that most large consumers of coal started the year 1959 with abnormally high stocks.

Considerable attention has been given by the industry during the year to regaining a footing in the coal export market, but without much material result. However, since the end of the year, there has been a marked change in the outlook as a result of the embargo recently placed on the export of coal by the government of India, which has already brought new business to the Union coal industry.

North Charterland Doubles Profits.—At £20,034, the profits of the North Charterland Company in 1959 were almost 100 per cent higher than in 1958. A dividend of 2d. per share has been declared. Prospecting by the Anglovaal Charterland Exploration Company continued during the year on the company's mineral concession in N. Rhodesia. Meeting, Salisbury, May 16.

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GEOLOGIST required for large Mining Organization in Southern Rhodesia. Qualified, age between 25 - 30. Free housing, pension scheme, life assurances, outward passage paid. Salary and other details of the appointment would be discussed at interview. Write, full particulars of qualifications, age and experience, to BOX "A.E.", c/o J. W. Vickers and Co. Ltd., 7 Great Winchester Street, London, E.C.2.

Rand and Orange Free State Returns for March

GOLD OUTPUT AND PROFIT

Company	March 1960 Tons (000)	March 1960 Yield (oz.)	March 1960 Profit† (£000)	Year ends	Current Financial Year Total to Date Tons (000)	Current Financial Year Total to Date Yield (oz.)	Current Financial Year Total to Date Profit† (£000)	Last Financial Year Total to Date Tons (000)	Last Financial Year Total to Date Yield (oz.)	Last Financial Year Total to Date Profit† (£000)
Gold Fields										
Doornfontein	93	38,014	186·9	J	850	345,812	1710·8	790	328,473	1685·4
Libanon	112	26,631	57·7	J	999	235,343	557·0	882	208,717	482·8
Luipaards Vlei	68	11,842	4·8	J	628	112,452	47·9	629	109,323	47·6
Ristfontein	16	4,178	6·5	D	48	12,625	20·9	48	12,732	22·7
Robinson	45	9,801	0·3	D	139	28,378	L19·9	196	40,672	L63·5
Simmer & Jack	78	13,971	L5·3	D	234	40,934	L44·0	258	49,307	L5·3
Sub Nigel	66	15,252	17·3	J	590	139,220	171·4	593	142,830	219·2
Venterspost	109	28,177	24·6	J	1,117	283,116	518·6	1,147	286,179	521·7
Vlakfontein	52	18,474	87·9	D	153	54,683	258·6	148	53,254	251·3
Vogels	86	18,383	20·6	D	260	55,597	64·6	276	62,714	125·4
West Drie	112	102,992	879·9	J	970	888,679	7548·6	738	700,165	5721·6
Anglo American										
Brakpan	146	17,380	13·5	D	422	51,122	34·0	407	48,694	28·1
Daggas	232	46,650	228·4	D	693	139,458	684·0	699	142,813	728·2
East Daggas	105	17,851	40·6	D	311	52,582	118·4	283	47,159	84·5
F.S. Geduld	90	77,626	608·6	S	560	479,220	3839·0	448	339,096	2474·4
President Brand	110	89,101	756·7	S	687	562,350	4945·1	580	439,800	3759·4
President Steyn	95	36,859	138·0	S	604	237,500	1086·2	557	217,349	1107·4
S.A. Lands	96	20,024	42·4	D	283	59,029	125·2	273	57,412	164·2
Springs	102	14,353	15·0	D	311	43,173	45·5	307	42,246	29·3
Vaal Reefs	90	40,300	194·4	D	278	125,100	647·5	239	108,668	567·6
Welkom	90	28,441	41·0	S	577	181,979	421·6	545	165,861	461·7
Western Holdings	144	96,120	791·9	S	853	531,931	4618·7	603	357,617	2713·3
West. Reefs Ex.	131	36,877	107·4	D	400	112,472	364·5	341	88,241	242·4
Central Mining										
Blyvoor	126	82,206	604·6	J	1,148	752,231	5693·8	959	628,675	4550·6
City Deep	113	24,008	5·0	D	331	69,888	17·2	338	70,762	31·6
Cons. M.R.	70	14,734	5·6	J	785	149,935	63·1	1,232	181,563	129·3
Crown	206	34,224	9·5	D	615	101,986	29·8	655	102,261	24·6
D. Roodepoort	196	35,734	51·5	D	571	104,246	150·4	549	101,062	154·3
East Rand Prop.	228	57,755	96·3	D	652	166,940	281·8	645	166,075	353·2
Harmony	149	59,832	252·7	J	1,284	511,851	2266·2	913	366,042	1434·6
Modder East	141	13,413	L3·0	J	1,221	119,267	7·4	1,196	118,441	19·3
Rose Deep	27	4,355	1·5	D	80	13,225	3·3	117	16,206	L0·1
J.C.I.*										
Freddies Cons.	56	12,746	L50·0	D	173	39,410	L131·0	166	41,521	L108·6
Govt. G.M.A.	34	11,080	0·5	D	159	32,286	1·6	165	31,852	L16·7
Randfontein	20	3,861	3·1	D	67	12,667	9·4	89	15,551	23·3
Union Corporation										
East Geduld	139	40,658	268·2	D	401	118.089	772·6	390	119,616	805·3
Geduld Prop.	75	13,510	25·0	D	222	40,602	82·5	206	38,154	41·7
Grootvlei	220	45,873	237·7	D	645	134,706	695·1	595	126,230	618·8
Marievale	102	24,888	127·8	D	297	72,685	374·1	265	67,014	317·5
St. Helena	150	50,255	295·2	D	460	153,333	930·4	415	123,250	647·2
Van Dyk	76	12,821	11·2	D	215	36,742	33·8	225	42,450	75·1
Winkelhaak	83	25,730	115·0	D	242	74,345	319·5	206	48,285	63·8
General Mining										
Buffelsfontein	130	51,402	230·0	J	1,285	496,495	2582·7	1,103	375,294	1728·1
Ellaton	26	6,196	18·2	D	83	19,738	72·4	91	21,488	90·2
S. Roodepoort	30	7,069	22·1	J	269	64,111	204·3	267	63,451	211·9
Stilfontein	147	66,200	311·7	D	454	204,430	1048·4	387	196,002	1255·2
W. Rand Cons.	122	17,254	L11·6	D	373	52,768	1·2	387	55,865	46·4
Anglo Transvaal										
Hartebeestfontein	100	47,000	243·8	J	877	437,145	2657·4	779	84,847	2867·4
Loraine	67	14,238	L38·5	S	458	94,439	L129·3	446	87,056	L113·2
N. Klerksdorp	10	1,255	L5·8	D	32	3,702	L17·4	30	3,191	L24·8
Rand Leases	178	26,891	24·9	J	1,665	29,011	215·4	1,632	239,003	122·6
Village M. R.	30	4,713	1·5	J	372	42,089	7·1	242	42,865	7·8
Virginia O.F.S.	120	26,700	L24·1	J	1,187	270,511	125·1	1,016	262,684	311·5
Others										
Kleinfontein	81	10,720	3·1	D	238	30,544	3·3	245	32,069	9·1
Wit Nigel	19	4,403	5·9	J	156	39,268	46·7	160	38,806	53·6

Gold has been valued at 249s. 8d. per oz. fine (February 249s. 10d.). L indicates loss. † Working Profit. * Working Profit includes sundry revenue. Table excludes profits from Uranium, Pyrite and Acid, and also production from Uranium divisions at Luipaards Vlei, Randfontein and W. Rand Consolidated.

ESTIMATED URANIUM REVENUE

Company	Year Ends	March Profit (£000)	This Year (cum.) (£000)	Last Year (cum.) (£000)
Goldfields				
Doornfontein	J	15·0	134·0	133·0
Luipaards Vlei (*a*)	J	94·0	840·0	810·0
Vogels	D	55·0	165·0	152·0
West Drie	J	48·0	448·0	416·0
Anglo American				
Daggafontein	D	139·0	418·6	423·2
P. Brand	S	47·5	278·6	278·0
P. Steyn	S	62·1	365·7	363·0
Vaal Reefs	D	143·5	431·9	416·4
Welkom	S	59·2	348·1	342·0
West Reefs Ex.	D	162·9	488·1	472·8
Central Mining				
Blyvoor	J	131·8	1367·2	1383·9
Harmony	J	215·5	1805·3	1339·5
J.C.I.				
E. Champ d'Or (*b*)	D	7·0*	21·1*	19·4*
Freddies Cons.	D	30·0*	92·0*	98·0*
Govt. G.M.A.	D	23·0*	69·2*	66·1*
Randfontein (a)	D	110·1*	330·1*	322·5*
General Mining				
Buffelsfontein	J	208·0	1902·0	1787·0
Ellaton	D	18·0	52·0	59·0
Stilfontein	D	88·0	273·0	267·0
W. Rand Cons. (*a*)	D	207·1	630·6	598·0
Anglo Transvaal				
Hartebeestfontein	J	254·0	2355·6	2316·6
Loraine	S	34·0	215·0	206·0
N. Klerksdorp	D	10·5	32·0	32·0
Virginia O.F.S.	J	177·3	1593·3	1660·5

Table includes profit from uranium, acid and pyrite before loan redemption. (*a*) Total profit from uranium section. (*b*) Overall profit. * Net revenue after provision for loan redemption.

Publications Received

The Eastern Metals Review. *Annual Number Vol. XIII, No. 1. published by Eastern Metals Review. Calcutta, pp. 186, Price Rs. 5.—(Post Free).*

This issue, divided into eight sections, gives a comprehensive survey of the metal industry in India today, including articles in the General Section on programmes for India's third five-year plan, accounts of the growth of the Indian steel industry, and a Statistical Section giving details of India's exports and imports, and graphs of market prices for various commodities.

The Engineer Buyers Guide, 1960 Edition, *published by "The Engineer", London, pp. 976, Price 9s. 3d.*

This Guide is an up-to-date list of suppliers of a wide variety of engineering products and services, arranged under approximately 2,650 classified headings, with cross references to help the user. Some 1,849 firms are listed under these various headings so that all branches of the industry are represented, and addresses and other details of companies whose entries appear under various cross references are listed in a Special Address Section.

Platinum Metals Review, *published by Johnson Matthey & Co., London, pp. 80*

Vol. 4, No. 2 of this quarterly review, contains an article on the principles of the solion; articles on various aspects of the uses of platinum metals, with many illustrations; a section devoted to abstracts on the subject from current literature and an account of new patents.

Good Business *Vol. 1, No. 1, published by the Central Office of Information, London, pp. 64.*

This new quarterly designed to promote exports has been produced for the Commonwealth Relations Office, and will be distributed to a selected list of businessmen and senior government officials in India, Pakistan, Singapore, Malaya and Hong Kong. Well produced and profusely illustrated, its purpose is to show how British industry can serve the needs of these countries.

Minerals Year Book 1958, *published by the U.S. Department of the Interior, Bureau of Mines.*

Volume 1, now available, on metals and minerals, except fuels, includes a statistical summary, and chapters on mining technology, metallurgical technology and employment and injuries. This comprehensive volume provides a record of performance of the U.S.'s mineral industries during the year, with enough background information to interpret the year's developments.

★

Mineral Map of Northern Rhodesia, 2nd edition, has been issued by the Geological Survey Branch of the Northern Rhodesian Ministry of Labour and mines.

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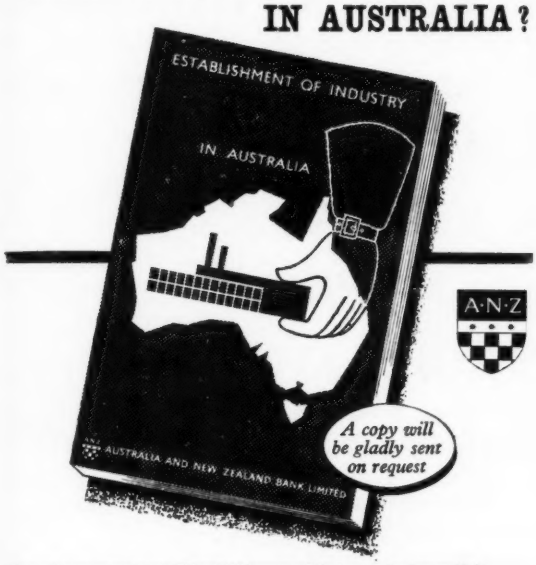
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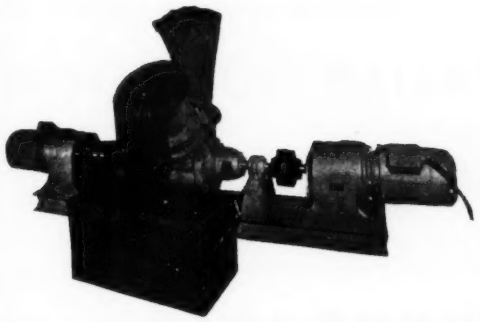

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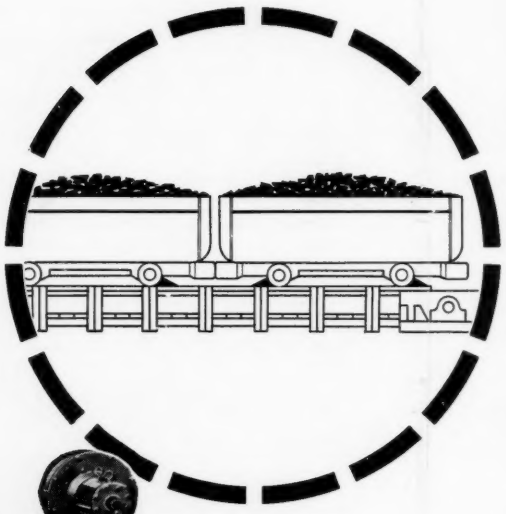

MINE CAR CREEPER, 30 ft. long and handling two cars of 7 tons capacity, which has been installed at a South Wales colliery.

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Published by The Mining Journal Ltd., 15 Wilson Street, Moorgate, London, E.C.2, and printed by Washburn & Sons Ltd., Queens Road, Southend-on-Sea, Essex. Registered as a Newspaper.